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Railway Mechanical Engineer

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The traveling engineer's ability

It is no reflection on the general worth of that splendid body of industrious, enterprising, able and practical railroad officers, the traveling engineers, to say that they don't always "know their stuff." Probably not one of them would maintain that he is functioning 100 per cent. The complete performance of their duties is so essential to the efficient functioning of the railroad machine, however, that, unless they do approach reasonably near the 100 per cent goal, undesirable locomotive conditions will continue largely undetected; crews will develop wasteful or unsafe practices through lack of instruction; fuel will be wasted; train operation will be delayed, and railroad net income will be reduced. These facts should act as a spur, causing every traveling engineer to examine himself critically, discover, if possible, his own weak points, and take steps to remedy them, improving his knowledge of mechanical details and general railroad operation, and, in particular, fitting himself for what is perhaps his most important task, namely that of leadership and instruction. In conducting this self-examination, the traveling engineer cannot do better than answer the following pertinent questions, presented in an able paper on this subject by D. C. Buell before the 1925 convention of the Traveling Engineers' Association in Chicago: "(1) What responsibilities are placed upon me by my position and title? (2) What are the specific duties of my position? (3) What are the desirable ends that I should accomplish in carrying out my duties? (4) Have I the proper attitude of mind toward my work? (5) Have I the proper attitude of mind toward my men? (6) Am I fulfilling my proper duty to myself in fitting myself for further promotion? (7) Am I training an understudy so that there will be a man trained and ready to step into my position when I am promoted?" Clearly, a traveling engineer's ability must not be summed up solely in a knowledge of mechanics and locomotive running. He must know how to direct, instruct and inspire men, transmitting to them his own loyalty to his road and a keen desire to co-operate in furthering its interests.

National meeting of mechanical engineers

The American Society of Mechanical Engineers has announced an extensive technical program for the railway mechanical engineer, which is to be presented during the annual meeting of the society in New York, December 3 to 7, inclusive. The program, which appears in the news section of this issue, consists of thirty-three papers. Of this number, four are being presented by the Railroad Division at two sessions. These four papers should represent the high technical standards that the Railroad Division has been striving to attain during the past three years. They are of a timely nature, and the division is fortunate in having them presented by men whose positions eminently fit them to handle their subjects. J. W. Martin, Jr., chief engineer, Dry Ice Corporation of America, is scheduled to present a paper on "Refrigeration in railroad freight cars," and R. M. Ostermann, vice-president, The Superheater Company, is to present a paper on "The characteristics of injectors with special reference to their utility as locomotive feedwater heaters." Both of these papers are scheduled to be presented at the morning session on Wednesday, December 5. In the afternoon, a paper on "The Schmidt high-pressure locomotive of the German State Railways," by R. P. Wagner, superintendent, locomotive department, German State Railways, and a paper on "The balancing and dynamic rail pressure of locomotives," by R. Eksergian, Baldwin Locomotive Works, are to be presented.

The remaining twenty-nine papers are being presented by other divisions of the society; such as the Machine Shop Practice, Materials Handling, Oil and Gas Power, etc. The authors of these papers are practically all mechanical engineers in industrial service. Three papers on illumination are being presented jointly with the Illuminating Engineering Society and three papers on refrigeration and heat transfer are also being presented at joint sessions with the American Society of Refrigerating Engineers. Mr. Martin's paper on "Refrigeration in railroad freight cars" is one of these papers.

It can well be said that this meeting will be a gathering of the master minds of the mechanical engineering profession. The American Society of Mechanical Engineers should be complimented on the idea of culling the program of the annual meeting for all papers having any possible bearing whatsoever on the work and problems of the railway mechanical engineer, and consolidating them into a railroad program. The railway mechanical engineer is in a position to contribute information of value to other industries. This action, which is sponsored by the railway mechanical engineering membership of the society, is also evidence of the fact that the railway mechanical engineer is modest enough to believe that he can learn from what is being done in other industries.

The annual meeting of the American Society of Mechanical Engineers, together with the National Exposition of Power and Mechanical Engineering which is held in the Grand Central Palace, New York, at the same time, has been established for many years. Both the annual meeting and exposition have been well attended in previous years by railway men. The ex-

tensive program of interest to them this year should be a special inducement for a good railroad representation during the meeting in December.

It is generally accepted as a fact that the physical condition of locomotives in service is generally better at the present time than it has ever been before. This is indicated by the splendid records of many railroads with respect to engine failures as well as by the reports of the Bureau of Locomotive Inspection of the Interstate Commerce Commission. The declining percentage of the locomotives under or awaiting repairs is further evidence of a generally high average condition of maintenance. In the half month ending September 1, the percentage of all power in or awaiting repairs was 13.4 per cent, which is the lowest percentage of any reported for the same period in any year since the Car Service Division figures have been available. What is of even greater interest is the fact that the percentage of locomotives undergoing or awaiting running repairs has decreased more proportionately than has that of the locomotives awaiting or in the shops for class repairs.

Better maintenance and less of it

This improvement in the condition of power has been accompanied by a decrease in the average number of locomotives turned out of the shops per month. In 1925 the monthly average of locomotives receiving class repairs was almost 3,600. In 1927 it had been reduced to something over 3,200, or a decrease of slightly less than 10 per cent. Comparing the first eight months of 1928 with the first eight months of 1927, the decrease in the average monthly shop output was from 3,300 to slightly over 3,000, or approximately another 8 per cent decrease within the year. While there has been no such consistency in the trend of the number of locomotives receiving running repairs during the years 1925-27, there has been a marked decrease during the first eight months of 1928 as compared with the same period in 1927, from 65,000 per month to 57,000 per month, or a decrease of approximately 12 per cent.

An evidence of the efficiency with which the work is being done in the shops may be seen in the trend of the number of machinists and boiler makers employed by the Class I railroads. In the middle of July, 1925, there were 60,400 machinists on the railway payrolls. In July, 1926, there had been a reduction of less than 100. In July, 1927, however, the number had declined to 58,500, and in July, 1928, to 55,300—approximately 12 per cent less than were employed at the same time in 1925. The proportionate decline in the number of boiler makers has been even greater. There were 19,600 on the payrolls in July, 1925. A year later there had been a reduction of a few more than 200. In July, 1927, however, the number had been reduced to 18,300, and in July of the current year, to 16,600—a reduction of a little more than 15 per cent since 1925.

What do these figures indicate? In the first place they offer fairly good evidence that a high standard of maintenance is cheaper in the end than a low standard of maintenance, under which no work is done until it becomes physically impossible to operate the locomotive longer without doing it. There are, however, several other factors which have influenced the gradual reduction in the number of men employed in locomotive maintenance. One of these is the extensive program of locomotive retirements which has been in effect for several years past and which has removed a large number of old locomotives, the maintenance of which, particularly that pertaining to the boilers, was extremely expensive. Another factor, which is believed to have been sufficiently extensive in its operation to have influenced the general average, is a widespread concentration of maintenance work at the larger and better equipped back shops and engine terminals. Where locomotive runs have been extended, engine terminals have been completely closed and there are numerous cases where small back shops have also been discontinued. Furthermore, the tendency to make light classified repairs at engine terminals, which was so strong a few years ago, has now been reversed, and the trend is toward a concentration of even heavy running repairs into as few shops and terminals as the conditions of the service will permit.

Longer locomotive runs have exerted a marked influence toward better organization and systematization of running repairs. The necessity for a highly developed and thorough inspection of locomotives operating over long distances and the concentration of running repairs at fewer terminals have both been conditions favoring more systematic and periodical attention than formerly when locomotives received running repairs, after runs of short mileage, at a large number of terminals, many of which were poorly equipped.

Another factor which has had a marked influence in producing these results is an improvement in the efficiency of back shop operation, both in the matter of methods, organization, and in the enthusiasm of the personnel, which, in one case, for instance, produced such results as a reduction in force from 1,200 to 700 in two years with no change in output.

The end has not yet been reached. There are still many locomotives in service, the maintenance of which is too high in proportion to the amount of service rendered by them when compared with the possibilities of modern power. There are still roads operating inefficient engine terminals and poorly equipped outlying back shops. There are many other back shops where work is being concentrated in which the possibilities for the utilization of better shop equipment and for a greater specialization in processes and methods, which the concentration makes possible, have not been fully realized. There are still sore spots in organizations which have not yet been ironed out. Some of these, in fact, are the result of insufficient consideration of, and lack of square dealing with, supervisors in the wholesale readjustments which have been taking place. Carrying the present program through to completion, will effect a still further improvement in maintenance conditions and costs. If, however, scrupulous attention is not paid to the interests of the many men affected by some of these changes, a loss of confidence and loyalty will be experienced, the effect of which it may take years to overcome.

The Master Car Builders' and Supervisors' Association, which was organized and held its first annual meeting at St. Louis, Mo., September 11 to 13, as reported in the October *Railway Mechanical Engineer*, promises to be an important factor contributing to increased car shop and car department efficiency. With the aggressive leadership and carefully prepared programs which seem assured, this association is apparently destined to receive the hearty support of influential mechanical department and operating officers throughout the country, permitting it to grow in numbers and influence as an educational agency covering those details and phases

Car shop efficiency

of car department operation not now receiving specific attention by any other national organization.

For example, at the St. Louis convention this year, the paper "Efficiency of car shop operation," by B. J. Huff, efficiency supervisor, Chicago & Eastern Illinois, together with the subsequent discussion, developed some fundamentals in car shop operating efficiency which need emphasis by constant repetition. Judging by the trend of expressed opinions, these fundamentals include adequate shop tools and equipment, organized material handling and the progressive system for heavy repairs, and, last, but not least, the provision of an added incentive for car-repair forces by means of the day-work system on a production basis, or the piecework method of wage payment.

Machine equipment essential

It was pleasing to note the general approval accorded Mr. Huff's remarks regarding the necessity for adequate car shop machinery and tools, including hand tools. One member said, "I never allow a man to use a car repair hammer, or what is known as the ball pein hammer for siding, because he will use more blows to put the nail home and he will mark the siding, whereas a man experienced in handling a 2½-lb. hatchet, day in and day out, will never mark a siding and he will never use more than two blows besides the starter for tenpenny nails, or one blow besides the starter for the roofing nails."

Heavy car shop machinery requirements should be analyzed thoroughly and systematically; new methods and tools should be introduced if actual checks of the work performed give promise of adequate savings. It was stated at the St. Louis meeting that two portable pressure riveters, for example, purchased for use in rebuilding 2,000 coal cars, "approximately doubled the output per man-hour, decreased the cost of driving $.008 per rivet, and also gave a much better grade of work than could have been performed with a pneumatic hammer."

In another instance, the installation of a journal-turning lathe, which permitted turning car journals without dismounting the wheels, resulted in a saving of $.82 per pair of wheels having the journals turned. The wheel shop was equipped with new machinery, including a modern wheel lathe, double-head axle lathes, boring mills, a double-acting wheel press, etc., as a result of which the wheel shop force was said to have been reduced 36 per cent, accompanied by a corresponding reduction in the cost of operation. The discussion of shop machinery at the convention emphasized strongly the need that car department supervisers study their respective machinery and tool needs, backing up their recommendations for new equipment with accurate, comprehensive and convincing statements of the possible savings.

Organized material handling

The question of material handling is vital in relation to car shop efficiency, and one of the reasons for the successful introduction and rapid expansion of the "spot," or progressive system of car repairs, is the facility with which all material, required in heavy car repair operations, can be segregated, handled in bulk, and delivered at the exact point where it will be used, thus reducing to a minimum the labor of handling. It goes without saying that suitable tractor and trailer equipment, and good hard roads between the storehouse, car shops and rip tracks, are a great time and money saver. Power winches or tractors for moving cars in shops are a paying investment.

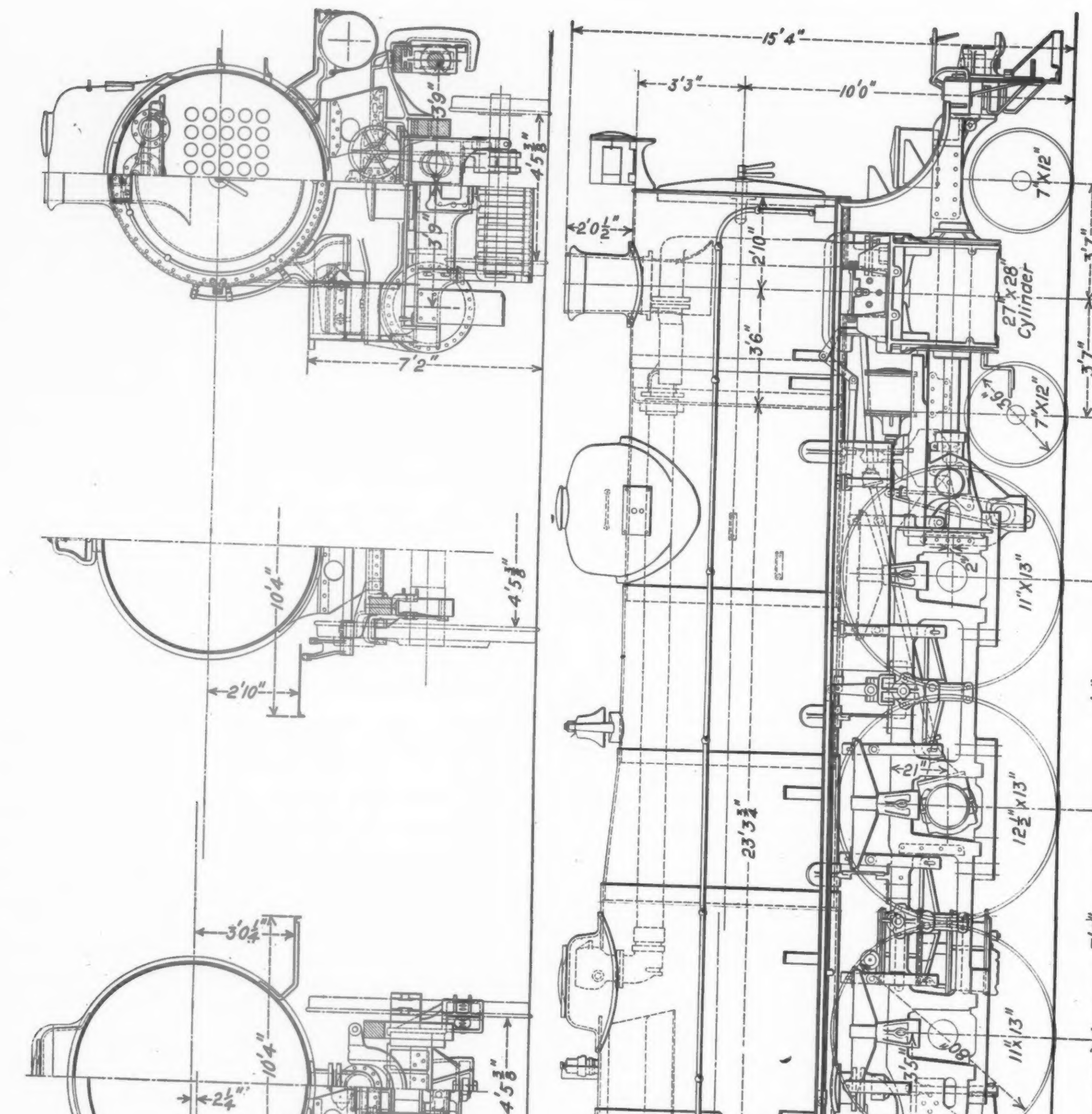
It was developed by the St. Louis convention that the particular organization for material delivery must be suited to individual requirements at each shop or repair point, the general effort being to keep car repairers all the time at their own work (repairing cars) and seeing to it that material is delivered to them where and when needed. In many cases the time required to get certain items of material is greater than the time required to apply it, and one car man at the convention, who has had experience developing material delivery systems at two or three shops, stated that, when properly functioning, these systems make possible material increases in output up to 50 per cent without anything like a corresponding increase in cost.

Aside from the advantage in reduced material handling, the progressive system of car repairs greatly facilitates in placing men at work for which they are best adapted, and at which they soon become expert. A quotation from the proceedings in this connection will be of interest. One member said, "You will find men in car repairing who are very good roofers; you will find others who are very good at splicing center sills and underframes on wooden equipment, but who wouldn't be worth their salt otherwise. You will find other men who are good inside men, deckers, liners, etc., who wouldn't be any good on underframes or on the roof." It is also true that some car repairers are frequently better adapted for light than heavy repair work, or vice versa. In some cases men who couldn't make a satisfactory center-sill splice are particularly adept at such work as changing wheels, drawbar work, putting on grab irons, making repairs to running boards, etc. The progressive system of making heavy repairs may safely be said to have justified itself both on the score of more efficient work and reduced labor in handling material.

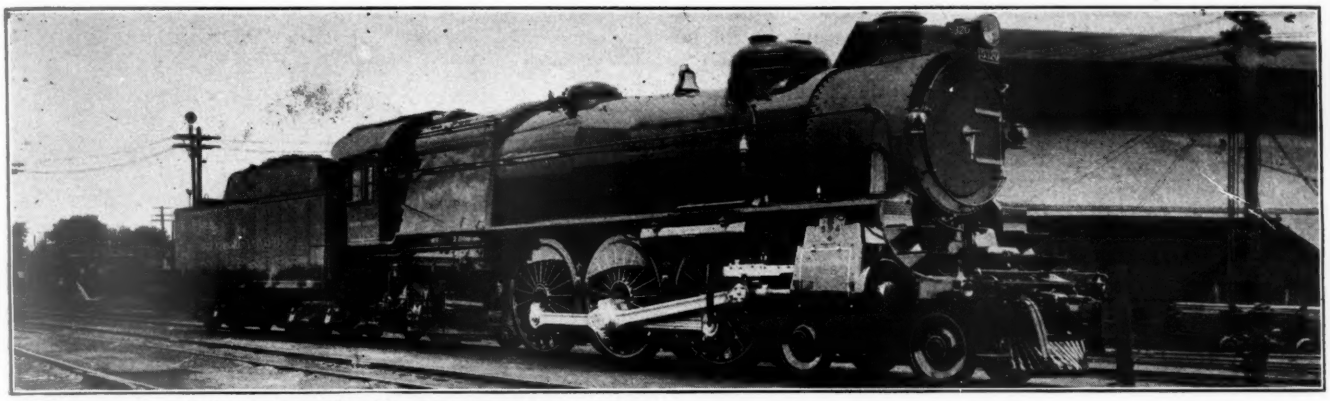
The pro and con of piecework

The *Railway Mechanical Engineer* is on record as favoring the piecework method of wage payment in general, which does not mean that under some conditions it may not be desirable to use some sort of production system on a day-work basis, involving the assignment of definite tasks to each man, with the possibility of checking individual efficiencies.

The advantages of piecework compared with day work, as developed in the discussion at the convention, however, in general over-balanced the disadvantages. A car department superintendent said, "I think that the various systems, day work, progressive scheduling, piecework, etc., go hand in hand. We all can't work piecework; we must have some day work. We find, indeed, that the scheduling system and the piecework system are very closely affiliated. Any road repairing cars by the scheduling system, and later installing piecework methods, will find that their scheduling system will have to be speeded up." A general car foreman said, "I have worked the piecework system and the day-work system without the spot system. I want to say if you work the spot system on a piecework basis that your output is more than with the day-work basis." A car shop superintendent said, "I don't hesitate to say that when general repairs are given to a freight car, and the average cost of any given unit or combination of units of work is $1.44, you can accomplish that work by assigning those cars to a given class work, piecework shop for $1.00, and in many shops we can go lower than $1.00."



Cross section and elevation of the Baltimore & Ohio 4-6-2 type locomotive equipped with a Caprotti valve gear and a water tube firebox



Baltimore & Ohio 4-6-2 type locomotive, No. 5320, "President Cleveland"

Caprotti gear applied to the "President Cleveland"

Baltimore & Ohio conducting tests with 4-6-2 type locomotive exhibited at Atlantic City

CONSIDERABLE interest has been shown for a number of years, both in this country and abroad, in the development of the Caprotti poppet valve gear. This interest increased, especially in this country, when the Baltimore & Ohio applied a Caprotti gear to a 2-8-0 type locomotive for experimental purposes. The gear was in continuous service on this locomotive for about 15 months, when it was removed in May of this year and applied to the Baltimore & Ohio 4-6-2 type locomotive, "President Cleveland." A brief description of the "President Cleveland" was included in an article published in the June 20, 1928, Daily Railway Age, describing the track exhibit at the American Railway Association Convention at Atlantic City, N. J.

The "President Cleveland" was built at the Mt. Clare, Md., shops of the Baltimore & Ohio and, during the process of breaking in early in June was given a number of dynamometer tests. These tests were made over the Cumberland division, eastern lines, between Keyser,

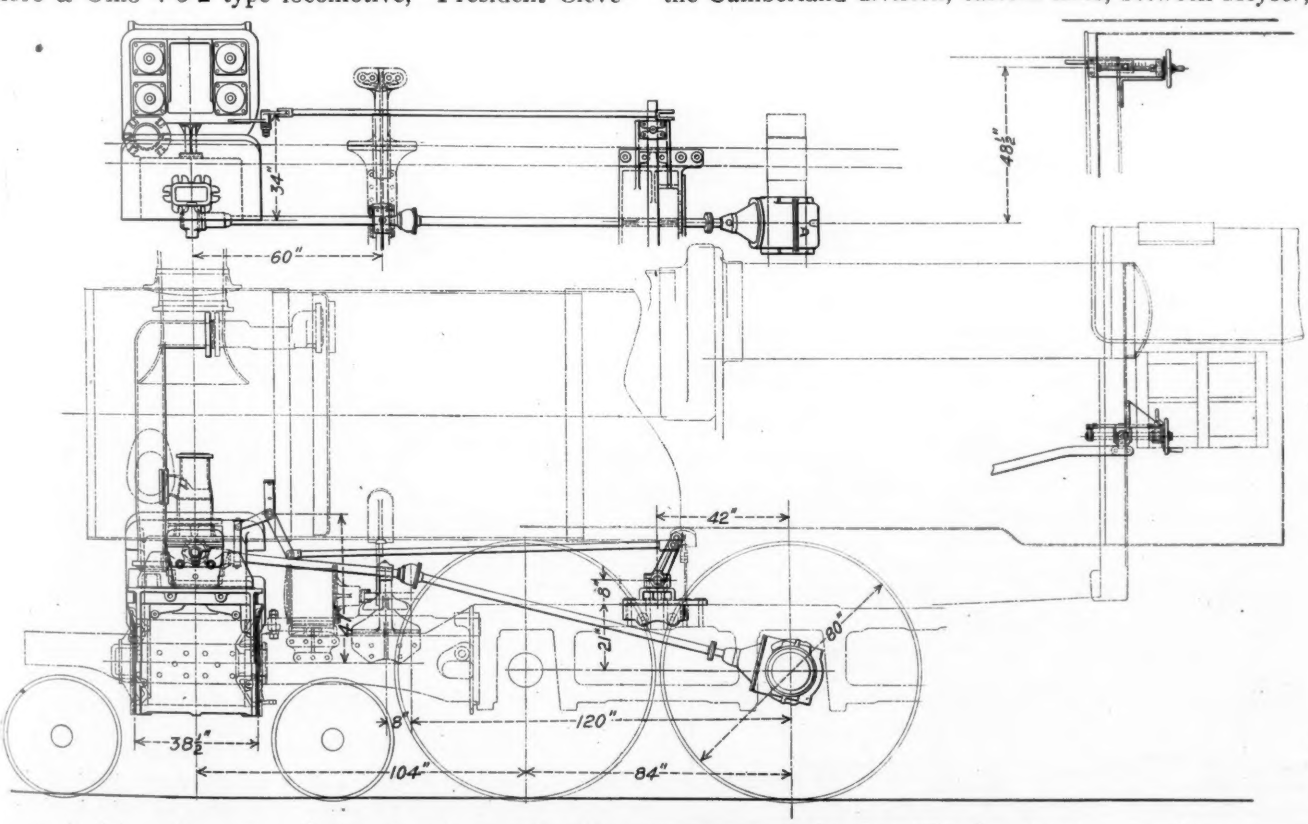


Fig. 1—Side elevation showing the arrangement of the Caprotti valve gear

W. Va., and Brunswick, Md. It was reported at that time that in all probability further test runs would be made between New York and Washington, D. C., Washington and Pittsburgh, Pa., and Pittsburgh and

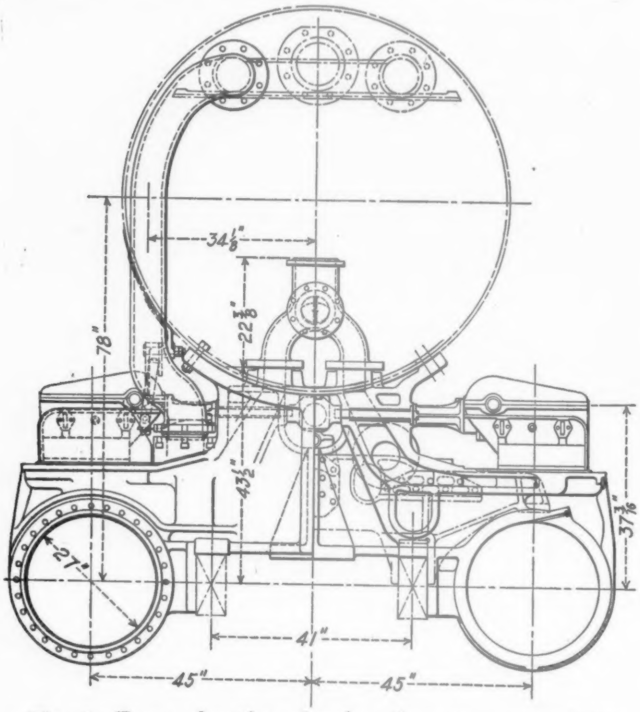
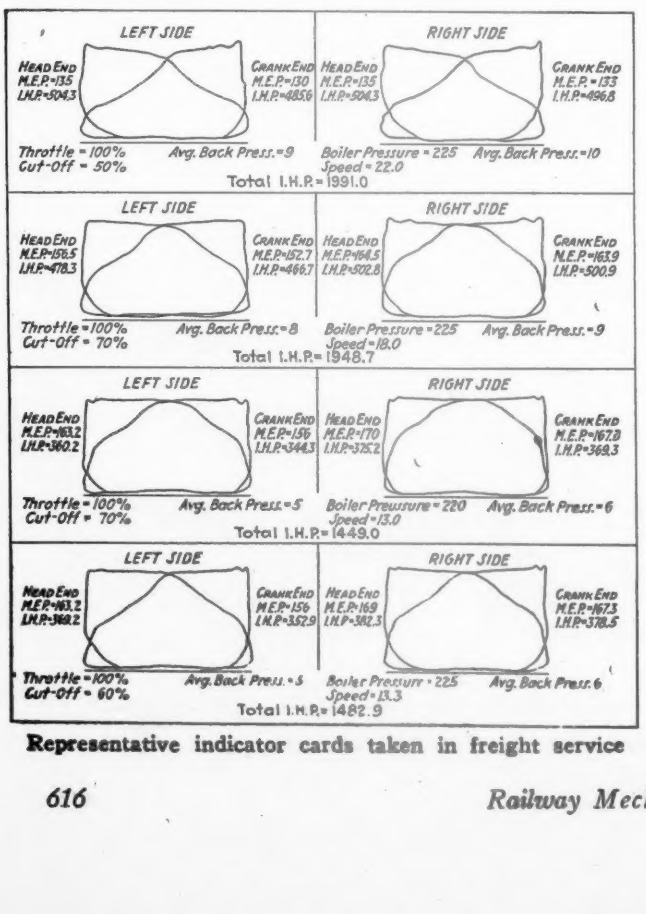


Fig. 2—Front elevation showing the gear arrangement

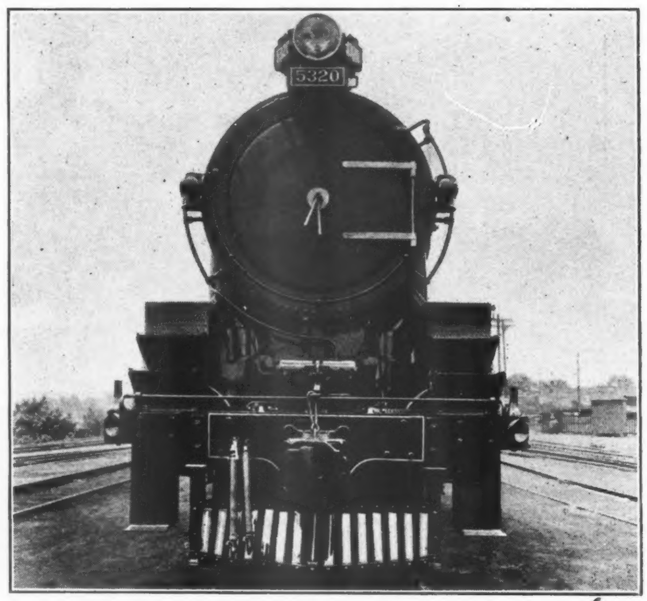
Chicago. No information relative to these contemplated road tests has as yet been released for publication.

Marked resemblance in lines and finish to British design

As in the others of its "President Class" locomotives, the railroad has exercised particular care in the design to make the lines of the locomotive as smooth and pleasing to the eye as possible. To one familiar with British

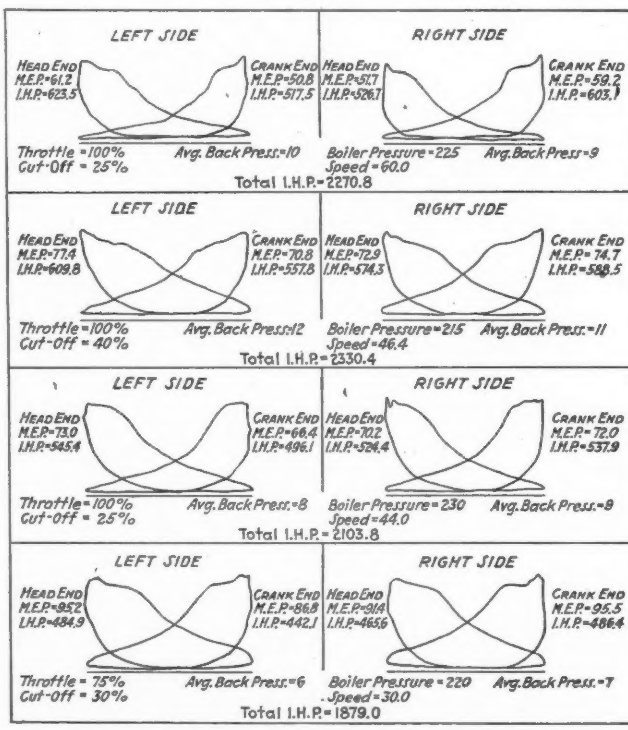


Representative indicator cards taken in freight service



Front end of the "President Cleveland"

locomotives, a marked resemblance in lines and finish will at once be apparent. The air compressor is located between the frames, back of the main drivers; the headlight generator is on the rear deck on the left side, convenient for adjustment from the ground. The pip-



Representative cards taken in passenger service

ing, as far as possible, has been suspended from the running boards, and the air pipes and a number of other pipes are welded to eliminate threaded joints. The exhaust steam pipe to the Elesco exhaust steam injector is placed between the frames and is carried through the ash pan at the rear of the locomotive.

Tests with the Caprotti valve gear

The "President Cleveland" was carefully broken in in both freight and passenger service, at which time complete dynamometer records were made and indicator

cards taken. Representative indicator cards, shown in two of the illustrations, taken at various speeds and working conditions in both passenger and freight service, show an indicated horsepower as high as 2,330. At no time during the road tests, in which the cards were taken, was the locomotive hauling its maximum rated tonnage. At the time the passenger service indicator cards were taken, the actual tonnage behind the tender was 750, while the usual passenger train tonnage over the Cumberland division is about 900.

A table showing the average results obtained from the road tests with the "President Cleveland" between Keyser and Brunswick, was included in the article published in the June 20, Daily Railway Age. Some of the figures given in that table are: Coal consumption per drawbar horsepower hour, 2.41 lb.; coal consumption per square foot of grate per hour, 42.22 lb.; water consumption per pound of coal, 7.35 lb.; steam consumption per drawbar horsepower, 19.59 lb. The average drawbar pull was 19,082 lb. during the eastbound trip and 20,736 lb. during the westbound. The boiler efficiency averaged between 61 and 62.1 per cent. The actual tonnage hauled on the eastbound trip was 3,628, and 1,499 on the westbound.

Table showing the principal dimensions, weights and proportions of the "President Cleveland"

Railroad	Baltimore & Ohio
Builder	Baltimore & Ohio
Type of locomotive	4-6-2
Service	Passenger
Cylinders, diameter and stroke	27 in. by 28 in.
Valve gear, type	Caprotti
Weights in working order:	
On drivers	203,500 lb.
On front truck	62,000 lb.
On trailing truck	64,000 lb.
Total engine	329,500 lb.
Tender	240,000 lb.
Wheelbases:	
Driving	14 ft.
Total engine	37 ft. 1 in.
Total engine and tender	78 ft. 2 7/16 in.
Wheels, diameter outside tires:	
Driving	80 in.
Front truck	36 in.
Trailing truck	52 in.
Journals, diameter and length:	
Driving, main	12½ in. by 13 in.
Driving, others	11 in. by 13 in.
Front truck	7 in. by 12 in.
Trailing truck	9 in. by 14 in.
Boiler:	
Type	Conical (water-tube firebox)
Steam pressure	230 lb.
Fuel, kind	Bituminous
Diameter, first ring	86 13/16 in.
Firebox, length and width	120 in. by 84 in.
Water tubes, number	110
Water tubes, diameter, outside	2½ in.
Water tubes, average length	6 ft. 4 in.
Tubes, number and diameter	205—2¼ in.
Flues, number and diameter	40—5½ in.
Length over tube sheets	23 ft. 3¾ in.
Grate area	70 sq. ft
Heating surfaces:	
Firebox	117 sq. ft.
Water and arch tubes	340 sq. ft.
Total firebox	457 sq. ft.
Tubes and flues	4,138 sq. ft.
Total evaporative	18 deg.
Superheating	80 ft.
Comb. evaporative and superheating	5,783 sq. ft.
Tender:	
Water capacity	4,595 sq. ft.
Fuel capacity	1,188 sq. ft.
Journals, diameter and length	17½ tons
General data, estimated:	
Rated tractive force	12,000 gal.
Curvature, normal speed	6½ in. by 12 in.
Curvature, slow speed	50,000 lb.
Turntable, length	13 deg.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	62.4
Weight on drivers ÷ tractive force	4.07
Total weight engine ÷ comb. heat. surface	56.9
Boiler proportions:	
Tractive force ÷ comb. heat. surface	8.65
Tractive force × dia. drivers ÷ comb. heat. surface	692
Firebox heat. surface ÷ grate area	6.54
Firebox heat. surface per cent of evap. heat. surface	10
Superheat. surface per cent of evap. heat. surface	25.9

Indicator cards taken in passenger service at speeds of 60 m.p.h. and at 25 per cent cut-off, showed a total indicated horsepower of 2,270.8. At a speed of 46.4 m.p.h. and 40 per cent cut-off, the cards showed an indicated horsepower of 2,330.4. At 44 m.p.h. and 25 per cent cut-off, the total indicated horsepower was 2,103.8, while 1,879 i.hp. was calculated at 30 m.p.h. and at 30 per cent cut-off. In the first three instances the locomotive was run with 100 per cent throttle open-

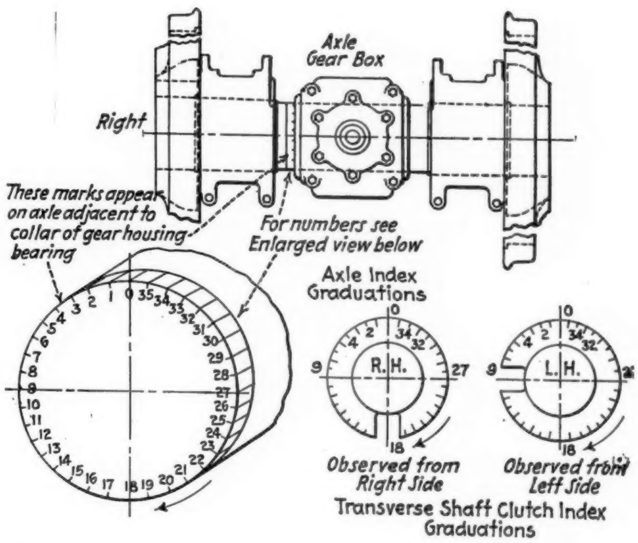


Fig. 3—Index graduations stamped on the driving axle and on the clutch collars of the transverse shafts

ing, while in the last the throttle was closed to 75 per cent opening.

The average back pressure ranged from 12 lb. to as low as 6 lb., the highest being obtained with a 100 per cent throttle and 40 per cent cut-off, and at a running speed of 45.4 m.p.h., while the lower figure of 6

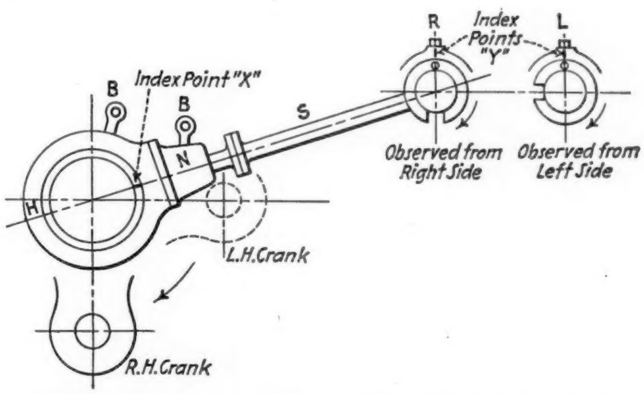


Fig. 4—Drawing to show the procedure used for timing the valves

lb. was had with a 75 per cent throttle, 30 per cent cut-off and at a running speed of 30 m.p.h. A variation in boiler pressure of 10 lb. occurred during the passenger service tests.

Somewhat lower back pressure figures were obtained in freight service, the highest being 10 lb. with a 100 per cent throttle and 50 per cent cut-off, and at a speed of 22 m.p.h., while the lowest back pressure figure was 5 lb., obtained with a 100-per cent throttle and cut-off of 60 and 70 per cent, and at a speed of 13 m.p.h. All of the tests in freight service were run with 100-per cent throttle opening. A total indicated horsepower of 1,991 was obtained with 50 per cent cut-off, at a speed of 22 m.p.h. At 18 m.p.h and 70 per cent cut-off, a total indicated horsepower of 1,948.7 was obtained. Indi-

cator cards at cut-offs of 70 and 60 per cent were also taken in the freight service tests at speeds of 13 m.p.h. and 13.3 m.p.h., respectively. The cards taken for the former showed a total indicated horsepower of 1,449, while the latter showed 1,482.9 i.hp. A variation in boiler pressure of only 5 lb. occurred during these tests.

The Caprotti valve gear

The Caprotti poppet valve gear is entirely different in principle from any other types of gears now generally applied to locomotives in this country.* Briefly, it is an angular motion gear, which follows all the angular positions of the crank during a complete revolution. It ob-

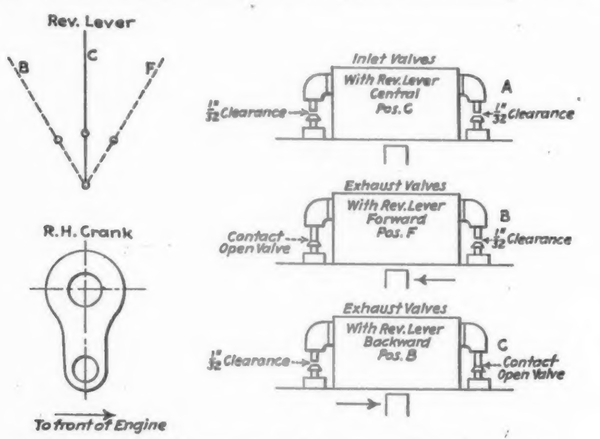


Fig. 5—Checking the valve stems for clearance

tains its motion from a gear attached to the driving axle.

On the 2-8-0 type locomotive, referred to in a preceding paragraph, the gear box is attached to the second driving axle and, on the "President Cleveland," to the main driving axle. (See Figs. 1 and 2). The gear on the axle engages with a pinion gear on a longitudinal main drive shaft, which is located between the frames. At the front end, the drive shaft is connected to a transverse gear box, located in the cylinder saddle at the back, which distributes the motion to trans-

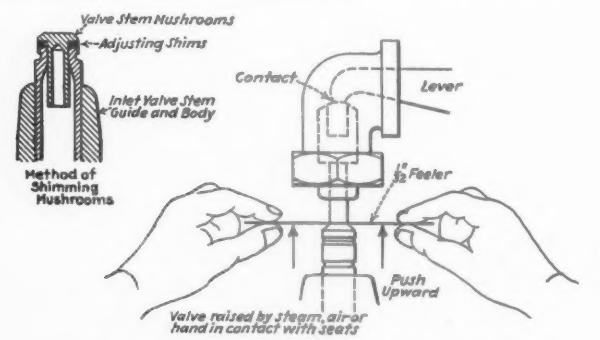


Fig. 6—Checking with a 1/32-in. feeler

verse shafts, and thence to the gear box located on each cylinder.

. Each cylinder is provided with four poppet valves. The two inlet, or steam valves, are located to the inside and the two exhaust valves, to the outside. These valves operate vertically in removable cages in the cylinder and their action is controlled by a cam mechanism in the gear box.

Setting the Caprotti poppet valve gear

It is not necessary to spot the engine to check the timing of the gears. The graduations, as shown in Fig. 3, are stamped on the driving axle next to the gear box, and on the clutch collars at the ends of the transverse shafts. These two sets of graduations are for use in timing the gears and for checking the lead. To read the index graduation, however, either one of the two gear boxes must be pulled out sufficiently on the cylinder to observe the reading on the clutch collar. A gage or index point is placed on the collar of the axle gear box bushing in line with the center of the drive shaft. Another mark is placed at the top center of the flange around each clutch collar, at the end of the transverse shafts. These index points, are shown by X and Y in Fig 4.

Gears are correctly timed for standard lead if, when any number on the axle is opposite the gage mark on the gear box bushing, the same number appears on either clutch collar opposite its gage mark.

The following procedure is used when timing the valves. Referring to Fig. 4, the axle housing H and the nose N must be blocked so that the drive shaft will be in proper working alinement. The eye bolts B are provided for this purpose. The nuts are then removed from the bolts which hold the nose N in place, then the nose N is withdrawn until the pinion on the drive

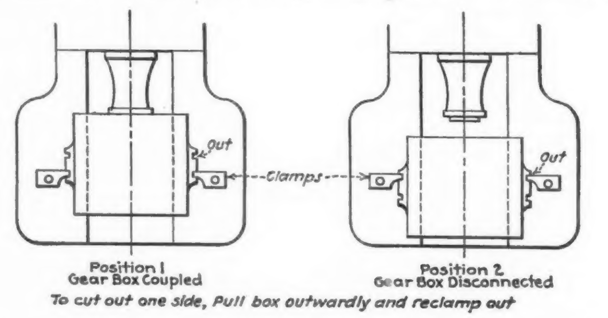


Fig. 7—Position of the gear box on the cylinder in running position

shaft disengages the axle gear. The mechanic then revolves the drive shaft S until the same number on either transverse shaft clutch collar agrees with the number on the axle, when opposite their respective index marks. After the numbers are checked and found to be correct, the nose N is pushed back until the pinion meshes with the axle gear. The nose N is then tightened and the blocking is removed. With the right crank pin on the bottom quarter, as shown in Fig. 4, and with the gears correctly timed, the small circle or zero on the clutch collars and axle should appear opposite their respective index points Y.

When the numbers opposite their respective index points on the axle and transverse clutch collars are the same, as explained in the preceding paragraph, the gears are timed for a 10-deg. lead. This is standard setting, and no change in the lead is permissible without instruction from the office of the mechanical engineer. A change in lead can be obtained by unmatching the number on the axle with the number on the clutch collars. However, under no circumstances should the lead be more than 5 deg., plus or minus, from standard. This corresponds to one-half of the space between the graduations as shown in Fig. 3. The lead can be increased by using what is termed, a fast index: for example, setting point 2 of the index graduation on the axle with the 2½ index graduation on the clutch collar. What is known as a slow index, is used to decrease the lead, such as setting the index graduation 2 on the axle, with 1½

* A complete description of this gear and its application to a four-cylinder compound locomotive by the Italian State Railways was published in March, 1927, issue of the *Railway Mechanical Engineer*, page 142.

on the clutch collar index. During the time that the Caprotti valve gear was used on the 2-8-0 type locomotive in freight service, the valves were set standard with a 10-deg. lead. The same valve gear, which is now on the "President Cleveland" is set fast with a 15-deg. lead.

Checking the valve stems for clearance

Checking the valve stems for clearance must be made with the engine spotted on either the bottom or top quarter. However, this work is easier performed with the crank pin on the bottom quarter, as shown in Fig. 5. Diagrams *A, B* and *C* in Fig. 5 show the proper clearances between mushrooms at the top of the valve stems and tappets, with the crank pin on the bottom quarter.

Referring to diagram *A,* in which the reverse lever is shown on center, the stems on the inlet valves should have 1/32 in. clearance at both front and back. In diagram B, with the reverse bar in forward position, the stem at the back exhaust valve should be in contact, while the stem at the front exhaust valve should have 1/32 in. clearance. In diagram *C,* with the reverse bar in backward position, the stem at the back exhaust valve should have 1/32 in. clearance and the stem at the front exhaust valve should be in contact. These clearances may be checked with a 1/32-in. feeler, such as a hack saw blade, as shown in Fig. 6. In checking the clearances, it is necessary that the tappet be pushed up so as to be in contact with the lever, as shown in Fig. 6. In addition, the valve must be fully seated. The mechanic can readily tell by sound when the valve seats. Clearances are adjusted to conform with Fig. 5 by adding or removing the shims under the mushroom at the top of the valve stems. Both sides of the locomotive are checked in this manner.

Position 1 in Fig. 7 shows the position of the gear box on the cylinder in running position. The clamp lugs are placed in the outer slots on the gear box. Should any part of the valve gear fail between the transverse gear box and the poppet valves in the cylinder, say on one side of the locomotive, and repairs are not possible on the road, the defective side can be cut out and the locomotive brought into the terminal by disconnecting as follows: Remove the casing from around the gear box, then loosen the clamp lugs on the cylinder and pull out the gear box until the extensions on the clamp lugs match with the inside slots on the gear box, as shown by position 2, Fig. 7. After this work has been completed, tighten the clamps.

Equipped with water-tube firebox

The water-tube firebox of the "President Cleveland" is 120 in. long and 84 in. wide with a grate area of 70 sq. ft. It has two longitudinal drums at the top, 30 in. in diameter, and two top and bottom longitudinal headers 7½ in. square. The top headers are connected to the top drums by seven 4-in. circulating tubes on each side. The bottom header, which forms the firebox frame, is connected to the barrel by one connection 9 in. in diameter at the center.

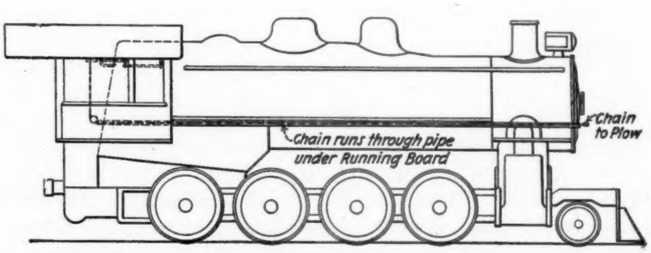
These top and bottom headers are connected together with two rows of 2½-in. diameter vertical tubes; these tubes forming the sides of the firebox. Opposite each vertical tube in the top and bottom headers are plugs which are used for the application and rolling in of the vertical tubes. In addition, the vertical tubes can be turbined at washout periods by the removal of the top plugs only. The novel feature of the firebox is that all the tubes can be applied and rolled and the entire boiler cleaned without the necessity of a workman having to get inside of the drums. It takes approximately 4½ hours to completely wash-out and clean the boiler and turbine the side tubes. There are no staybolts in the boiler.

The total saturated steam heating surface of the boiler is 4,595 sq. ft. This, with the superheating surface of 1,188 sq. ft., gives a combined heating surface of 5,783 sq. ft. The boiler has 205, 2¼-in. tubes and forty 5½-in. flues. In addition to the features already mentioned, the locomotive is equipped with a Standard stoker, Type BK; a screw reverse gear and a B. & O. type superheater.

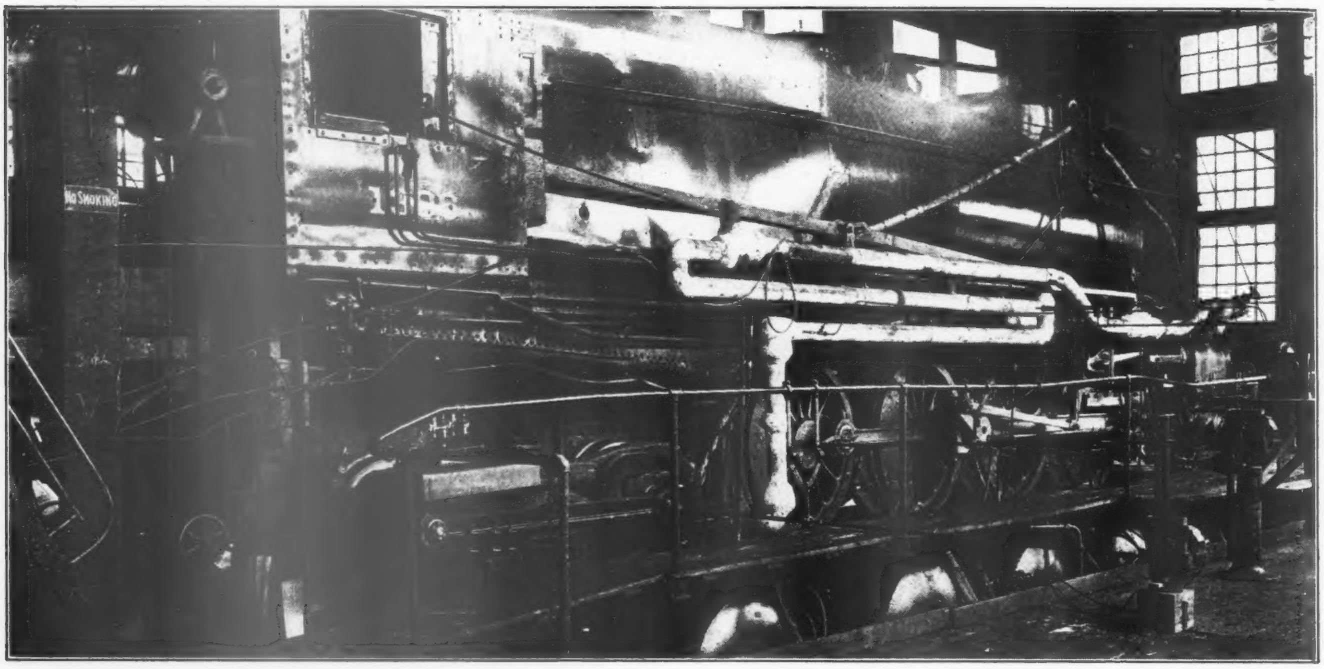
The important dimensions, weights and proportions of the "President Cleveland" are shown in the table. The locomotive develops a tractive force of 50,000 lb. which, with the weight on the drivers of 203,500 lb.. makes a factor of adhesion of 4.07. The diameter of the drivers is 80 in. and the boiler operates at a pressure of 230 lb. per sq. in. The cylinders are 27 in. by 28 in. The total weight of the engine is 329,500 lb., of which 62,000 lb. is on the engine truck and 64,000 lb. on the trailer truck. It has a total wheelbase of 37 ft. 1 in. and a rigid wheelbase of 14 ft. The tender has a bunker capacity of 17½ tons and a water capacity of 12,000 gal. The total loaded weight of the tender is 240,000 lb.

Whistle connection for snow plows

When it is necessary to use a snow plow, it is usually pushed by one or more locomotives. In this position, the plow throws up a blanket of snow which obstructs the view of the engineman, thus preventing him from seeing road crossing, signals or any possible obstruction in the track. The observer in the snow plow is usually located in the cupola, thus enabling him to see the track ahead. This man, then, should be the logical person to blow the locomotive whistle and give signals to the engineman. Working on this basis, the Bangor & Aroostook has equipped its locomotives so that the whistle can be blown from the snow plow. As shown in the illustration, a chain passes from the snow plow through a pipe located underneath the running board and then into the cab where it is attached to the end of the whistle lever. The chain and pipe remain on the locomotive at all times, thus making it a simple matter to connect with the chain in the snow plow when necessary.



The device is used on Bangor & Aroostook locomotives so that the whistle can be blown from the snow plow



Bethlehem auxiliary locomotive under the rear end of a Pennsylvania class L1S locomotive on the test plant at Altoona, Pa.

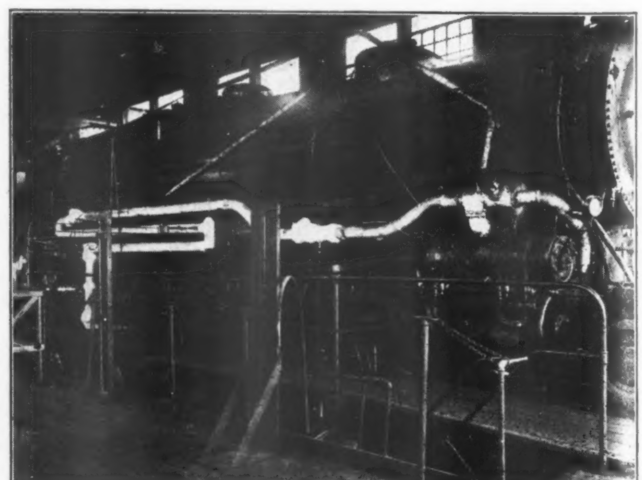
Plant tests on the auxiliary locomotive

Report on a series of tests run at Altoona—Develops drawbar pull of 12,022 lb. at 7.3 m.p.h.

DURING July and August of last year, the Bethlehem Steel Company, Bethlehem, Pa., with the co-operation of the Pennsylvania, conducted a series of tests on the Bethlehem auxiliary locomotive at the locomotive testing plant of the Pennsylvania at Altoona, Pa. These tests were conducted with the auxiliary locomotive working alone and also in operation with a locomotive as it is applied in actual service. Owing to the limited length of the testing plant, it was impossible to test the auxiliary locomotive as one of the trucks of a tender. It was, therefore, applied in place of the trailer truck to a 2-8-2 type locomotive (Pennsylvania class L1s). The steam supply pipe to the auxiliary locomotive was connected to both branch pipes of the locomotive. The usual number of bends and Barco joints were placed in the steam line to give the same length of pipe and resistance to steam flow, as if the auxiliary locomotive were placed in its normal location under the tender. The gears were blocked in mesh. The weight supported by the auxiliary locomotive was not ascertained, but it was sufficient to prevent slipping of the wheels.

The first tests were made for the purpose of comparing the results obtained with the locomotive working alone, and when assisted by the auxiliary locomotive. These preliminary tests were made at speeds of 40, 50 and 60 r.p.m., which correspond to 7.3, 9.2 and 11 m.p.h., respectively.

Full gear tests of the locomotive and at 80 per cent cut-off were made at all three speeds, while tests at 60 and 70 per cent cut-off were made at speeds of 7.3 m.p.h. and 11 m.p.h. Special tests of the locomotive alone were made to show the change in drawbar pull at 7.3 and 11 m.p.h. with various changes in cut-off. Tests were also made to determine the steaming capacity of the locomotive. In addition, a series of tests of the auxiliary locomotive was made to determine its characteristics when operated alone. In some instances, when the boiler pressure could not be maintained, or the results did not seem consistent, a duplicate test was run.



Arrangement of steam pipes to the auxiliary locomotive

All of the tests, except those conducted on the auxiliary locomotive when working alone, were made in pairs. In other words, a test of the locomotive and the auxiliary locomotive was followed by a test of the locomotive alone, the test of the locomotive alone starting as soon after the auxiliary locomotive was stopped as the firing rate, rate of boiler feed, branch pipe temperature, etc., became adjusted to the new test conditions. The locomotive and auxiliary, when operated together, were run at the same speed in miles per hour. Tests of the auxiliary locomotive alone were made at speeds lower than when it was operated with the locomotive. Starting tests were not attempted either with the locomotive or auxiliary locomotive on account of the danger of slipping.

The driving wheels of the locomotive were 62 in. in diameter and that of the auxiliary locomotive driving wheels, 36 in. The gear ratio of the auxiliary locomotive used in these tests was 2.25. The locomotive was hand fired with run-of-mine, bituminous coal.

When testing the auxiliary locomotive alone, the brakes on the locomotive and on the supporting wheels were released, and the locomotive valves placed on center, by disconnecting the lap-and-lead levers. This was done so that there would be no resistance offered by the locomotive to affect the drawbar pull readings of the auxiliary locomotive.

As no condenser large enough to take care of the exhaust steam from the auxiliary locomotive was available, the steam used by the auxiliary locomotive was measured by a steam meter connected to the supply pipe.

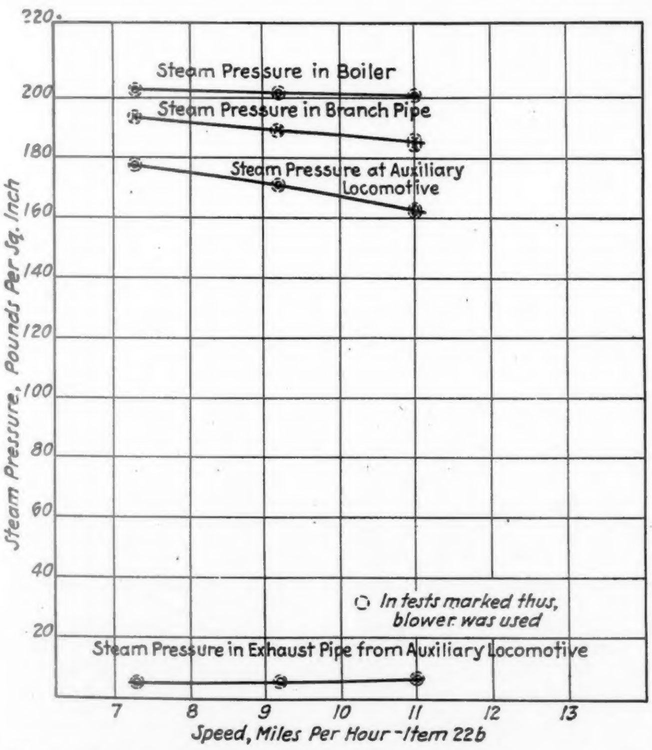
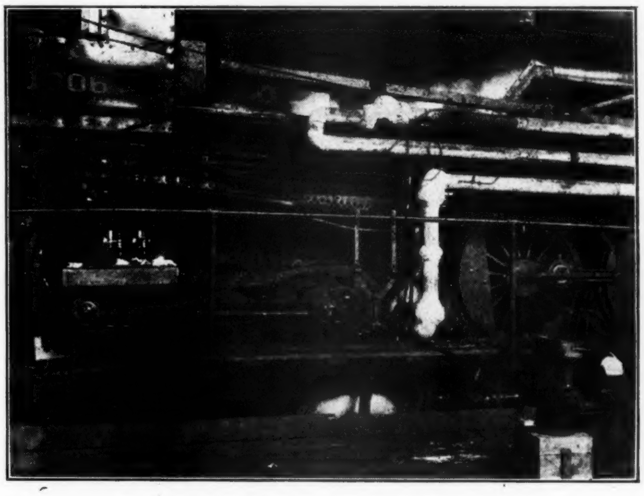


Fig. 1—Reduction of steam pressure with increase in speed

There is a drop in pressure in the steam supply to the cylinders of both the locomotive and the auxiliary, due to the resistance to steam flow, and as the rate of this steam flow varies with the opening and closing of the valves, a pulsation in pressure results, which makes the drop in pressure difficult to measure by means of Bourdon type gages and, therefore, a differential mercury type-U gage was used. The pressure drop between the boiler and branch pipe was measured when operating the locomotive alone, and the locomotive and auxiliary together. When operating the auxiliary alone, the pressure drop between the branch pipe and the cylinders of the auxiliary was also measured.

Steaming of the locomotive

A test was made on the locomotive alone at 160 r.p.m. and 65 per cent cut off, to determine if it was steaming freely and if it would develop as high evaporation as had been found in other class L1s locomotives. No difficulty was found in maintaining a steam pressure of over 200 lb. with an evaporation rate of 61,841 lb. per hour, (81,917 lb. equivalent evaporation) a combustion rate of 12,662 lb. of coal per hour and a steam temperature of 621 deg. F. However, in obtaining this maximum evaporation, the auxiliary locomotive was not used and all the steam was exhausted through the nozzle and utilized in producing draft. When operating the locomotive at long cut-offs, in conjunction with the auxiliary locomotive, the demand for steam exceeds the ability of the boiler to supply it, with the draft available, except at the lower speeds. The available draft can be augmented to some extent by the use of the blower, but not sufficiently to obtain the maximum evaporative capacity of the boiler at low speeds.



Throttle valve and indicators used during the test

Boiler pressures

A boiler pressure of 200 lb. or above was maintained in all of the tests of the locomotive when operated alone. When the auxiliary locomotive was used in combination with the locomotive, the steam pressure could be maintained up to an equivalent evaporation of 50,000 lb. per hour. Beyond this evaporation rate, the use of the blower was necessary. It was seen that the application of a stoker would in no way increase the steaming capacity of the boiler for the conditions under which the auxiliary locomotive was operated, but it would materially assist in sustaining these results under road operating conditions. It would eliminate the human factor. Also the firing rates attained represent rates beyond the capacity for road hand firing.

Reduction in branch pipe pressure

Referring to Fig. 1 the operation of the auxiliary locomotive caused an average reduction in branch pipe pressure of five pounds. Similarly, the pressure of the steam supplied to the auxiliary locomotive was subject to a greater drop when the locomotive was operated than when the auxiliary was operated alone. A comparison

of tests made under like conditions with and without the auxiliary locomotive, showed a difference in the average steam temperature of about five degrees. The steam in the branch pipe is at a higher temperature with the auxiliary locomotive in operation.

The indicated horsepower of the locomotive, when the auxiliary locomotive was in operation, showed the effect of the lower branch-pipe pressure and was somewhat less, at all speeds, than when the auxiliary was not used. The steam per i. hp. hr. averaged about 1½ lb. less than when the auxiliary was in use. The reduction in water rate of the main engines, when the auxiliary was in use, appeared to be rather large for the small increase in steam temperature obtained but, when the auxiliary was in use, the boiler was being worked at a higher rate. The temperature of the steam should, therefore, be higher and a reduction in the water rate of the main locomotive engine is to be expected.

Drawbar pull

The auxiliary locomotive adds to the drawbar pull, but does so at a lowered efficiency of the whole unit. In full gear at 7.3 m.p.h., the locomotive alone has an efficiency of 4.9 per cent. When working in full gear in combination with the auxiliary locomotive, the efficiency of the unit falls to 3.1 per cent. The drawbar

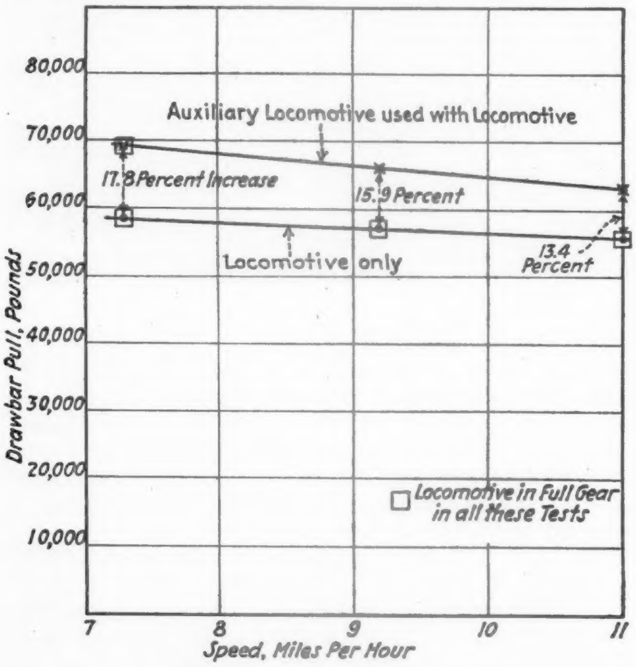


Fig. 2—Maximum drawbar pulls

pull under these working conditions is increased 10,442 lb., or 18 per cent, and the efficiency is decreased 37 per cent.

The drawbar pulls of the locomotive alone and the locomotive and auxiliary locomotive used together are shown in one of the tables. At 7.3 m.p.h., it was possible to operate the locomotive in full gear and also the auxiliary locomotive, giving a combined drawbar pull of 69,111 lb. The locomotive blower was required in this test to maintain boiler pressure.

No full gear tests with the auxiliary locomotive in service were made at speeds above 7.3 m.p.h. As full boiler pressure was maintained in the test in full gear at 7.3 m.p.h. with the auxiliary locomotive, it is probable that the locomotive could have been worked in full gear, with the auxiliary in use, at a slightly higher speed.

When operated together, the drawbar pull is less than the sum of the drawbar pulls at each individual unit, under the same test conditions, owing to the

Drawbar pull in pounds of the locomotive and the auxiliary locomotive working alone and in combination

Speed m.p.h.	Locomotive alone	Locomotive with auxiliary locomotive	Difference between locomotive with auxiliary and locomotive alone	Cut-off of locomotive per cent
7.3	58,669	69,111	10,442	Full gear
7.3	56,425	68,615	12,190	80
9.2	55,740	66,184	10,444	80
11.0	53,838	63,433	9,595	80
7.3	51,679	63,121	11,442	70
7.3	47,244	57,689	10,445	60

greater drop in steam chest pressure. This difference increases as the speed increases. The minimum speed at which the locomotive was run in these tests was 40 r.p.m., or 7.3 m.p.h. and it is probable that at lower speeds the total drawbar pull would approach the sum of the drawbar pulls of the two units and very nearly equal it at starting speeds.

The drawbar pull above the maximum of the locomotive

While the foregoing shows the increase in drawbar pull due to the auxiliary locomotive, for various test conditions, it does not show either the maximum pull of the locomotive alone, or the net increase due to the auxiliary locomotive, except at the lower speed of 7.3 m.p.h.

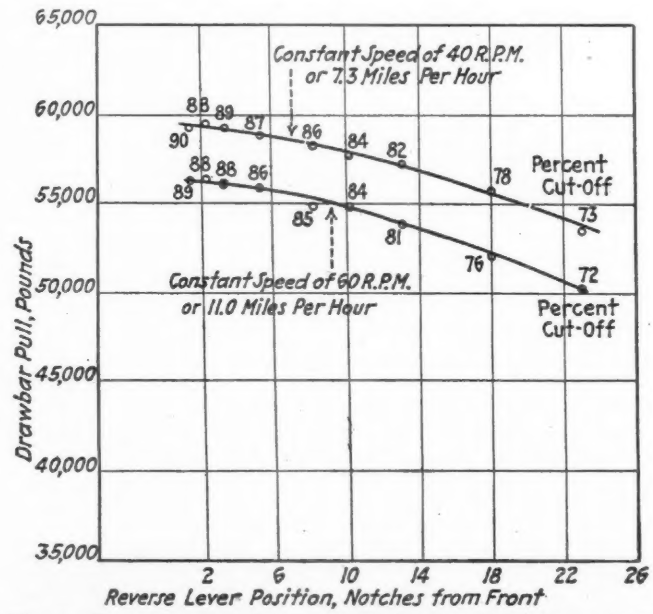


Fig. 3—Drawbar pull of the locomotive as affected by cut-off adjustment with constant speed

Tests of a class L1s locomotive, as recorded in Pennsylvania Bulletin 28, show maximum pulls at other speeds and tests were made of locomotive No. 1306 to confirm the results shown in that bulletin. These are

Net increase in drawbar pull due to the auxiliary locomotive

Speed m.p.h.	Maximum drawbar pull, lb. Locomotive alone	Locomotive and auxiliary loco.	Net increase in pull due to auxiliary locomotive Lb.	Per cent
7.3	58,669	69,111	10,442	17.8
9.2	57,084	66,184	9,100	15.9
11.0	55,964	63,433	7,469	13.4

tests No. 8249 at 50 r.p.m. (9.2 m.p.h.) and full gear cut-off, and No. 8250 at 60 r.p.m. (11.0 m.p.h.) and full gear. The drawbar pulls obtained are shown in one of the tables, which also shows the net increase in pull, due to the auxiliary locomotive.

The pulls of 66,184 lb. and 63,433 lb. at 9.2 and 11.0 m.p.h. were not made with the locomotive in full gear, but at 80 per cent cut-off. It may be that a slightly

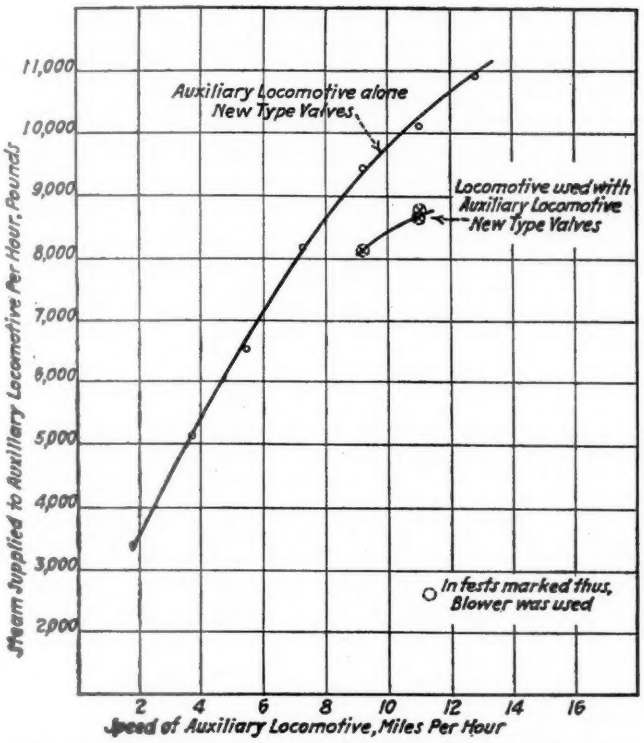


Fig. 4—Steam consumption of the auxiliary locomotive

greater pull is possible at 9.2 m.p.h. In this test, while the blower was used, the boiler pressure was easily maintained. The pull at 11.0 m.p.h. is a maximum as,

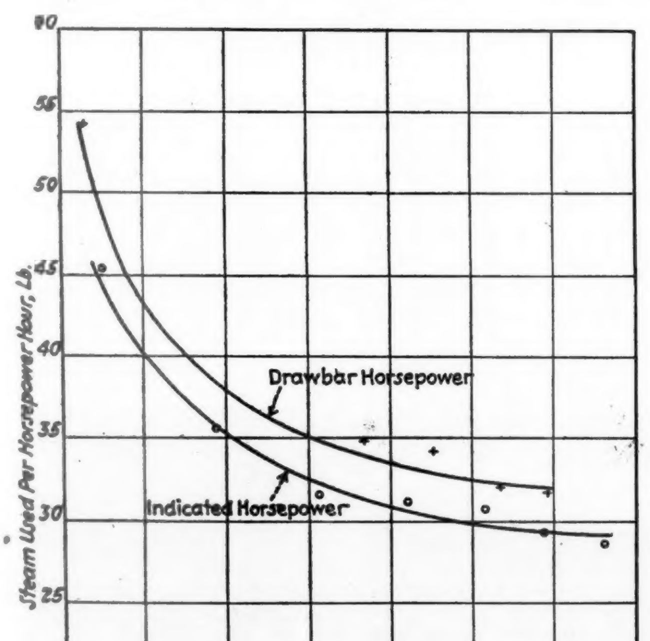


Fig. 5—Steam used per indicated and drawbar horsepower by the auxiliary locomotive

in this test, the blower was used and the pressure was not fully maintained throughout the test.

In the plotted results shown on Fig. 2, the drawbar pull of the locomotive and auxiliary at 9.2 m.p.h., falls on the curve and it is believed that the net increase shown is the maximum obtainable not only for 7.3 m.p.h., but also for 9.2 and 11.0 m.p.h.

Tests at long cut-off

In addition to the tests of the locomotive at 60, 70 and 80 per cent and full gear cut-off, it was desired to determine the effect on the drawbar pull when the cut-off was decreased by small increments from full gear, the speed remaining constant. This was done for two speeds, 40 and 60 r.p.m., or 7.3 and 11.0 m.p.h.

The principal data obtained in these tests are shown in Fig. 3. The cut-offs were about evenly spaced, in nine notches, between 70 per cent and full gear. The drawbar pull falls off as the cut-off is shortened. At 70 per cent cut-off, it is about 10 per cent less than in full gear and at 80 per cent cut-off. It is four per cent less for both speeds.

The steam per indicated horsepower-hour was not measured in these tests, as the time of running, in each

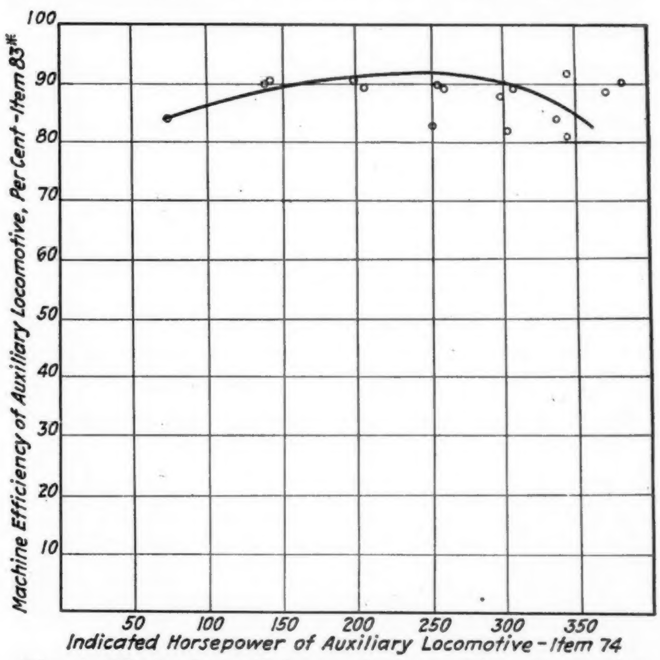


Fig. 6—Mechanical efficiency of the auxiliary locomotive

cut-off, was not long enough. This figure has been calculated from the heat apparently utilized in the cylinders, the quantity of heat being derived from the live and exhaust steam pressures and temperatures.

The auxiliary locomotive uses steam at rates of between 3,400 and 11,000 lb. per hr., when operating between about 2 m.p.h. and 13 m.p.h. The steam used per indicated horsepower-hour is from 45.5 lb. at 1.8

Results of tests of the auxiliary locomotive operating alone

Test No.	Duration of test, min.	Speed m.p.h.	Drawbar horsepower	Steam supplied per d. hp. hr. lb.	Drawbar pull, lb.	Machine efficiency, per cent
8241	10	1.8	63	54.2	13,083	84.0
8238	8	3.7	130	39.5	13,207	90.3
8237	10	5.5	185	35.4	12,617	89.4
8236	10	7.3	234	34.9	12,022	89.7
8235	10	9.2	276	34.2	11,222	89.6
8239	10	11.0	316	32.1	10,760	91.9
8240	10	12.8	345	31.8	10,093	90.3

m.p.h. to 28.7 lb. at 12.8 m.p.h. The indicated horsepower of the auxiliary locomotive was from 75 at 1.8 m.p.h. to 382 at 12.8 m.p.h.

The drawbar horsepower, steam economy (see Figs. 4 and 5) and machine efficiency of the auxiliary are

shown in the table. The machine efficiency (see Fig. 6) ranged between 84 and 92 per cent.

At a speed of 7.3 m.p.h., the machine efficiency of the locomotive in full gear cut-off is 9.3 per cent and that of the auxiliary locomotive at this speed, as shown in the table, is 89.7 per cent.

Improved arrangement for steam control

It will be noted that the chart, Fig. 7, on which the drawbar pull curves for the auxiliary locomotive, when operated alone, are plotted, shows curves for original and new type valves. A description of the original valve arrangement was published in the August, 1922, issue of

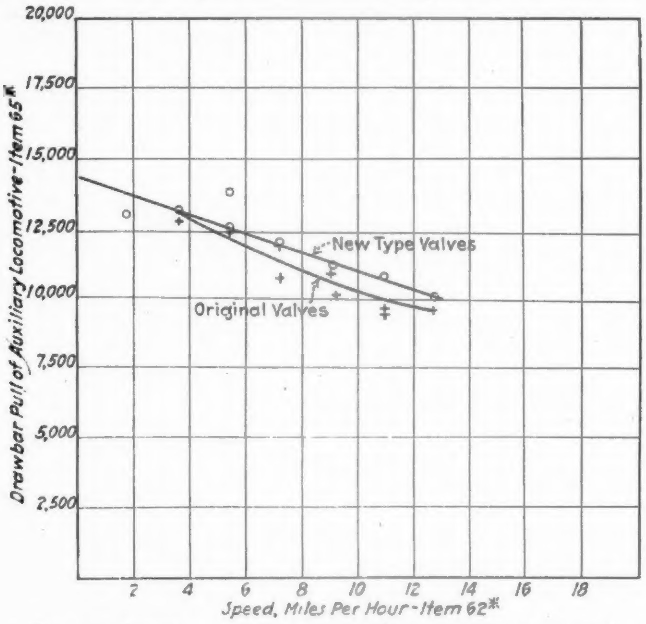


Fig. 7—Drawbar pull of the auxiliary locomotive when operated alone

the *Railway Mechanical Engineer,* page 441. With the new type valves, the steam supply to the cylinders of the auxiliary is controlled by piston valves located between the two cylinders, and the valve gear is driven by means of eccentric cranks attached to the crank-pins of the auxiliary engine shaft.

The driving shaft of the engine and the driving pinion are forged in one piece. The front truck axle is equipped with a large gear to which the power of the engine is transmitted by means of an idler that is located in a movable position in such a way that it is always in mesh with the driving pinion, but in or out of mesh with the large gear of the truck axle, as may be required. The truck axles are provided with outside cranks and connecting rods so that the power of the auxiliary engine will be transmitted to the four truck wheels between which the engine is supported.

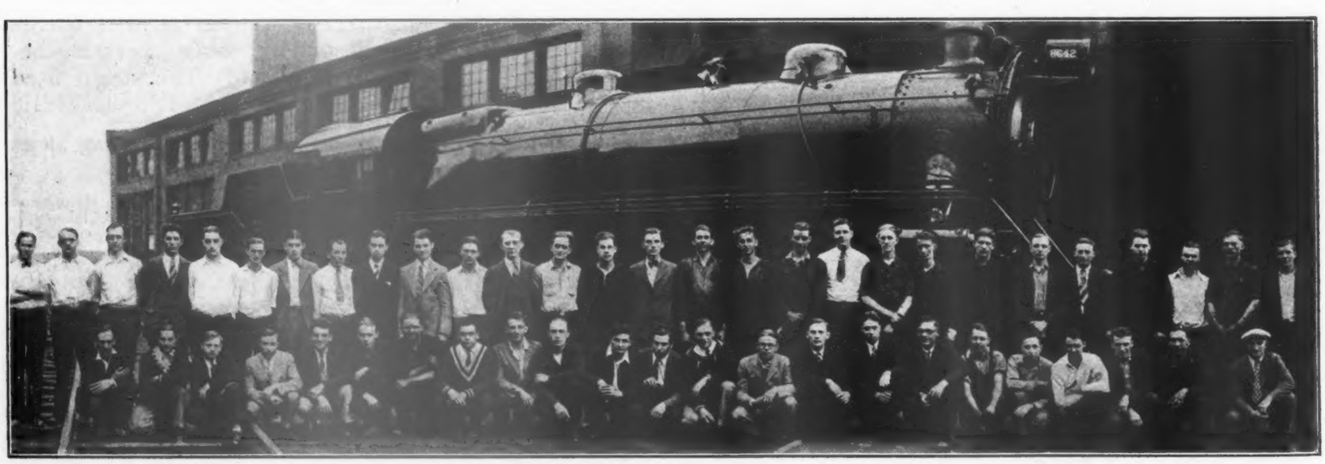
The movement of the idler gear is automatically controlled by a simple mechanical device which holds the idler gear out of mesh with respect to the large gear when the auxiliary engine is not in use. This movement causes the idler to engage the large gear of the truck axle whenever the auxiliary engine is started, and disengages it from the large gear when the auxiliary engine is shut off. The cylinders and valves of the engine are lubricated by a hydrostatic lubricator located in the locomotive cab.

Grade resistance of the auxiliary locomotive

This auxiliary locomotive, when applied to the tender of the class L1s locomotive, is installed in place of a truck weighing 10,930 lb. As the auxiliary locomotive weighs 31,500 lb., the net weight added is 20,570 lb., or 10 tons. The locomotive and tender, without the auxiliary locomotive, weighs 250 tons and with the auxiliary locomotive, 260 tons. The maximum drawbar pull of the locomotive alone is 58,669 lb. at 7.3 m.p.h. on a level track. Under these conditions of level track, the auxiliary locomotive adds to the drawbar pull 10,442 lb., or 17.8 per cent of the pull of the locomotive alone. Taking 20 lb. per ton as the grade resistance, we find that, on a three per cent grade, the locomotive pull will be 43,669 lb. and the pull added by the auxiliary locomotive, 9,842 lb. or 22.5 per cent. The pull added by the auxiliary locomotive is a larger proportion of the total pull when operating on grades.

Pennsylvania apprentice school at Columbus

MORE than 100 apprentices from the various departments of the Pennsylvania shops at Columbus, Ohio, have been enrolled in classes for instruction pertaining to their crafts in the apprentice school established in December, 1927. Classes are held each Saturday in a classroom on the second floor of the master mechanic's office building. Class work starts at 7:30



Graduates of the Pennsylvania apprentice school at Columbus, Ohio, shops, in front of a K-2 class locomotive just out of the shop on which they performed all the class repair work

a. m. and continues during the day until each class has reviewed the lesson for the week and receives instruction for the next week's study. Classes are divided into units corresponding with the different departments of the shop.

The subjects taught in the Columbus apprentice school are: Federal and state laws pertaining to, and affecting the construction and maintenance of locomotives and their parts. Following these instructions are lessons in shop practices, mathematics, drawing, blue print reading, tools, materials, etc.

After a full course of lessons or instructions, the apprentice is directed to demonstrate his knowledge of the work covered by performance. If he works in the machine shop, he must lay out shoes and wedges of a locomotive; set valves, set and line frames, and perform other work pertaining to frames, including cylinders. Following this, he must pass a final examination with a passing grade of 80 or better. More than 60 apprentices have successfully passed the required tests.

The school is arranged on a plan that gives an apprentice technical information and practical experience under competent instructors. These instructors are changed from time to time, the particular subject under study governing the choice of instructor.

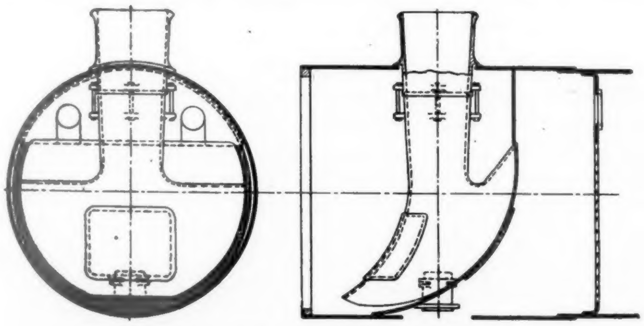
Of apprentices at Columbus shop, 91 per cent are graduates of the high schools of Columbus. Seven per cent have had two years in high school, and the other 2 per cent have passed the 9-B grade in the high school. Ninety-nine per cent of the apprentices in the Columbus shop are sons of employees of the Pennsylvania.

Front ends, grates and ash pans

Abstract of a paper presented at the recent convention of the Traveling Engineers' Association in Chicago*

By F. P. Roesch
Sales manager, Standard Stoker Company, Inc., Chicago

WE now come to the advent of superheated steam, and its effect on front-end design. The principal change consisted of moving the draft sheet; i.e., the adjustable plate, ahead of the nozzle, and the introduction of the superheater damper; practically all other parts were retained intact. About this time,



A suggested self-clearing front end

however, the locomotives grew larger; this meant a reduction of stack height above the smoke-arch or a shortening of the stack. This reduction in external stack height was in a measure compensated by lowering the exhaust stand and in some cases extending the stack down into the smoke-box; in other cases the petticoat pipe, generally out of line with either the nozzle or stack, or both, and supported on flimsy hangers, with its so-called overdraft and underdraft, was religiously adhered to. Zerah Colburn (writing in 1853) said the space between the top of the petticoat pipe and the base of the arch was to permit the smoke to escape. He never claimed, even in that day when there was nothing between the petticoat pipe and the flues, that the draft could be equalized by increasing or decreasing this opening. We wonder what answer he would make to a present-day engineer who claimed he could regulate the draft in this manner regardless of the interference of diaphragm, table plate, etc. It may be possible, but it is hard to see.

The Pennsylvania in the Altoona testing plant long ago demonstrated the fallacy of this reasoning. They also proved that it was possible to dimension the various parts entering into the front end draft appliances so that everything could be nailed into place in the back shop; then if the locomotive did not steam, some one would look for the real cause instead of moving draft plates, petticoat pipes, etc. More power to them!

All tests have shown a difference in front-end vacuum behind and in front of the diaphragm; the difference depending on the total vacuum. Does this not indicate that the diaphragm plate is an interference? Then why keep it? The Type E superheater is rapidly coming in, which removes the necessity for a damper, even if one ever were necessary, which some are inclined to question; therefore, why not do away with the diaphragm also, and, while we are at it, with the table plate and petticoat pipe? We offer the arrangement illustrated as a suggestion. Look it over and think it over before criticising. This design will give you a netting area greater than you have now. A drum-head effect that will help keep it clean. A shorter nozzle, a longer stack, and a direct pull on the tubes. If it looks good to you, try it. The idea may not be as crazy as it looks. Of course, some one will say, "How will we get at the superheater units with that big thing in there?" The answer is, "How do you get at them now?"

Locomotive grates have been subject to about as many changes as the front-end draft appliances, and while possibly due to the variation in the character of

* Mr. Roesch, in an introduction which is here omitted, traced the history of the development of locomotive front end arrangements both in this country and abroad, from early times down to the Purdue tests resulting in the Master Mechanics' standard self-steaming front end, then discussing the changes made necessary by the introduction of superheated steam.

the coal used in different parts of the country, it may not be practical to adopt a standard design, yet in the light of recent experiments it would appear that some modification of present types, particularly in stoker-fired engines, may be worth our serious consideration.

Grates

Designed originally simply to support the fuel and permit the inflow of the air necessary for its combustion, no particular uniformity appears to obtain insofar as the ratio of air opening to total grate area is concerned, or the relative size of the openings. Furthermore, up to the time of federal operation it seemed to be an open question as between finger and so-called table grates or modifications thereof.

It may be of interest in this connection to remark that in English practice the fixed, i. e. non-rocking grates are generally used, while on this side the rocking grate is favored, and, in the opinion of the writer, justly so, as in American practice the grate must possess another function in addition to those mentioned above; viz., to permit the easy and rapid cleaning and dumping of fires, removal of clinkers, etc., especially on locomotives used on extended runs.

It is not the purpose of this paper to recommend any radical departures, but simply to call attention to some recent developments on the Atchison, Topeka & Santa Fe and Northern Pacific, believing that the results obtained are well worth careful investigation and consideration as perhaps pointing in a direction heretofore passed unnoticed.

While under ordinary operation there is a difference of only about two ounces in pressure between that in the ash-pan and that in the fire-box, yet this difference is sufficient to set up an air or gas current, if you prefer, having a velocity of approximately twenty miles per hour immediately above the fire, and increasing very rapidly in its passage to the flues. A blast of this velocity is capable of lifting and carrying with it quite large particles of coal, and, especially where the grate openings are fairly large and so spaced as to permit the formation of holes through the fire-bed, can be considered the direct cause of the stack loss due to the discharge of unburned or partially burned coal commonly called cinders. Would it not, therefore, appear that a grate having fixed openings, small in size and equally spaced, would be the logical grate to apply?

With engines hand-fired the type of grate or size of air openings is not of as much importance; as generally the lumps of coal fired are larger, and, again, as the fireman looks at his fire with each supply of coal he can readily fill up any holes as fast as formed. Furthermore, knowing that too much air admitted is just as detrimental from a combustion standpoint as not enough, he restricts this flow by increasing the depth of the fire, as necessary. Again, as a man can only shovel a certain amount of coal in a given time, he must of necessity carry a fire of sufficient depth to meet any emergency.

Stoker firing is an entirely different proposition, however. In the first place the coal is reduced to a size best adapted for mechanical distribution. Naturally, in crushing lump coal to these dimensions, more fines—one-quarter inch or less—are produced than where the lumps are broken with a coal pick. The fire in stoker-fired engines should be carried much thinner also, as all stokers have sufficient reserve capacity to meet any sudden demand, thus obviating the necessity of heavy fires; therefore, it would appear that the grate best adapted for stoker firing is one that will permit carrying a very light fire without the possibility of too much waste through the grates or the possibility of tearing holes through the fire no matter how thin, or even admitting too much air should any part of the grate surface be actually uncovered. Remember, in stoker firing the fireman is not checking the condition of his fire at frequent intervals, as in hand firing, and therefore the possibilities of an uneven fire are much greater. Therefore, is it not logical so to design the grate as to reduce the detrimental effect of uneven fires—banks and holes—to a minimum?

The amount of air opening through the grates has long been a moot question, ranging in hand-fired engines from twenty-two to fifty-five per cent of the total grate area. Experiments on the Santa Fe and Northern Pacific with practically all kinds of coal, excepting anthracite and including lignite, would indicate, however, that with a fire carried at the proper depth, a grate having a ratio of from twelve to eighteen per cent—small openings equally spaced—will not only admit enough air under practically all conditions and with any kind of bituminous or related coals, but at the same time reduce the possibility of an over-supply. The experiments have also apparently demonstrated that such a grate reduces the stack loss, particularly in stoker-fired engines, as well as the formation of clinkers; that the fire can be kept at the right depth just as easily as with other types of grates, and be cleaned as readily at terminals or where necessary. At any rate, it would appear that this type of grate is worth looking into as another item of design affecting locomotive operation.

There is another and a rather compelling reason that should cause us to consider the adoption of a grate with smaller air openings, viz., the possibility of taking advantage of the market and burning screenings when they are available at a price sufficiently below that of mine-run coal to justify. Screenings make an ideal stoker fuel, although not well adapted for hand firing; but, even if used in connection with a stoker, it is necessary to have a properly designed grate in order to realize the fullest possible economy.

Brick arches

While, strictly speaking, the brick arch cannot be considered a draft appliance, yet as an improperly designed or improperly applied brick arch has such a material effect on locomotive operation, we think it well to refer briefly to this very important adjunct.

In the early development of railroads in the United States, apparently no objections were raised either to noise or smoke. Therefore, while in the beginning some roads followed English practice insofar as the application of brick arches is concerned, not so much to eliminate smoke, but because the more progressive railroad officers realized the fuel economies obtainable through its application, yet owing to the difficulty in maintaining arches (generally supported on studs tapped into the side sheets), the general use of the arch was later discontinued, and not revived until an arch supported on arch tubes was designed, as is our present practice. Even then it is doubtful if the arch would have been generally adopted had it not been for the universal campaign, especially by large cities, for smoke abatement.

The railroads applying brick arches with this end in view soon found that, in addition to reduced smoke, very material economies in fuel were also obtained. This fact was stressed by the International Railway Fuel Association, and later by the Fuel Conservation Section during Railway Administration days, so that practically all railroads fell into line, until now it is more uncommon to see a locomotive without a brick

arch than formerly to see a locomotive with one.

In the design and application of brick arches, however, the same lack of uniformity appears to obtain as with grates, front end draft appliances, etc. It was at one time considered good practice, and a practice which in many cases is still adhered to, to use a spacer brick between the arch and the throat-sheet so as to leave an opening varying anywhere from 3½ in. to 10 in. presumably on the theory that as the draft carried the cinders over the top of the arch they would fall down again through this opening and so be consumed, or on the theory that if the arch was against the throat-sheet, making what is called a sealed arch, cinders would collect on top of the arch and stop up the lower flues. Both of these theories, however, apparently have little if any foundation in fact. On the contrary, the open arch was one of the most prolific causes of flue leakage.

In the earlier locomotives the brick arch was not extended back as far as might have been economically advisable, as any rearward extension had a tendency to throw the flame back correspondingly, resulting in there being so much heat at the firedoor that locomotives could not be hand fired with any degree of comfort. Therefore, arches were kept moderately short.

With the advent of the mechanical stoker, however, the same objections could not be raised against bringing the flame back against the door-sheet so as to obtain the full benefit of all the fire-box heating surface. It was also found that, owing to the tendency of the finer particles of coal being carried further, a bank was liable to form where the open arch was used. Therefore, in order to settle the question as to the best design of brick arch, taking everything into consideration, i.e., fuel economy, smoke elimination, evaporation per pound of coal due to increased fire-box temperature, etc., tests were conducted, and it was found that a sealed arch, extended back until the opening between the top of the arch and the crown-sheet was equivalent to about 115 per cent of the total flue area, a reduction in fuel consumption ranging from 10 to 15 per cent would be obtained over an open and short arch wherein the opening between the top of the arch and the crown-sheet was equivalent to from two to two and one-half times the total flue area.

We believe this is a subject well worth your serious consideration.

Ash-pans

Obviously, ash-pans were originally applied as a receptacle for the ashes shaken through the grates. There is no need to go into the development of the ash-pan, as naturally it had to change with the change in locomotive construction, but apparently some designers are still of the opinion that the only purpose of the ash-pan is that for which originally intended, viz., a receptacle for ashes, and apparently not realizing that it is one of the most important adjuncts affecting combustion that is placed on the locomotive. In the beginning of this article we spoke of the draft appliances located in the front end, the function of which was to maintain a partial vacuum in the fire-box. The amount of vacuum necessary in the fire-box to burn fuel at a certain rate depends, of course, on the difference in pressure above and below the grates. The fact was also mentioned that under ordinary operating conditions the pressure in the fire-box is only about two inches less than that of the surrounding atmosphere. If, therefore, the ash-pan is so designed that sufficient air cannot flow under the grates to maintain atmospheric pressure, it follows that in order to obtain the necessary difference in pressure a higher vacuum must be created in the fire-box, and this, as previously shown, is usually obtained by reducing the nozzle, which, in turn, results in higher back pressure and so affects locomotive operations.

It has generally been recognized that an ash-pan air opening equivalent to 14 per cent of the total grate area is sufficient under practically all conditions to maintain atmospheric pressure under the grates. Some very recent tests have demonstrated, however, that even with this ratio of air opening a partial vacuum equal to .6 in. of water frequently occurs under the grates under certain operating conditions, and, of course, this partial vacuum under the grate is equivalent to reducing the vacuum above the grate by an equal amount. Therefore it might be well to take this into consideration, and in designing ash-pans increase the effective air opening to, say, 16 per cent of the grate area instead of 14 per cent.

With the present-day wide fire-box extending beyond the frame, it is sometimes quite a difficult matter to develop an entirely satisfactory ash-pan; the construction of what is termed the cradle casting being such as to make it necessary to pinch the center of the pan in so as to permit it to come between the frame, and then flare it out to the width of the mud ring or a little beyond. Therefore if the pan is dropped far enough below the mud ring to obtain the necessary air opening, it often follows that the flare of the pan has not sufficient slope to permit the ashes to slide down into the tapered part of the pan, and particularly where the grate connecting rods are brought well out from the center line. The result is that where the design of the pan shows plenty of air opening so long as the pan is clean, yet as soon as the grates are shaken once or twice, enough ashes will accumulate on the comparatively flat surfaces to restrict very materially the inflow of air, and in this way defeat the very purpose aimed at when dropping the pan below the mud-ring.

Inasmuch as the lack of sufficient air under the grate so very materially affects combustion, coal consumption, steaming of the engine, etc., it would appear that a little more consideration could be given to the ash-pan design, with a view to developing one that will meet every requirement.

Coal gates

It might sound like a far cry from the design of a coal gate to locomotive operation, but when we stop to consider a recent case wherein an important passenger train, pulled by a hand-fired engine, was delayed 40 minutes due to the design of the coal gate (of course, the size of the coal also entered into the proposition), it shows that there is, nevertheless, a very intimate relation between the two.

It has been observed that in recent construction a type of practically solid sheet iron coal gate is favored. Usually they are made in four sections, in the form of gates swinging inward. Re-enforcing strips in the shape of angle irons are riveted to the inner sides of the gates. There is no question but that a gate of this construction is strong, substantial and effective insofar as preventing the loss of coal from the gangway is concerned, regardless of whether the tender is loaded with lump, mine-run, or screenings.

There is another factor to be taken into consideration in this connection, however, besides a gate that forms an effective barrier against the loss of coal, viz., the possibilities of train delays when such a gate is used in connection with a stoker-fired engine, due to the

arching of the lumps of coal over the conveyor trough, and the fact that when these lumps do arch in this manner, particularly when the tender is carrying practically a full load of coal, it is often almost impossible to break the arch down so that coal will again feed into the conveyor trough.

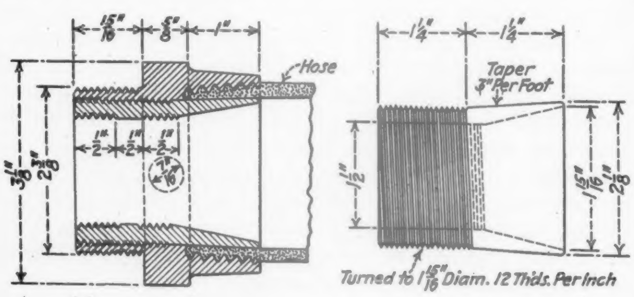
During the war there was a form of coal gate developed and used on locomotives built for the government, termed the Dunham gate. This consisted of a series of heavy planks set into pockets on each side of the coal space, being set at an angle so that each of the boards which extended clear across the coal space sloped back, leaving a space between the bottom of one plank and the top of the next through which a shaker bar could be used for breaking down any lumps that were too large to pass under the lower board.

We are not advocating the return of this type of gate, but believe that the principle involved might with profit be incorporated in the iron gates now being used. At any rate, if there would be objections toward incorporating this principle, the angle iron re-enforcing pieces could at least be moved from the back to the front side of the coal gate where they would be equally as effective as stiffeners, would serve as toe-holds when one wished to climb over the gates, and would remove what practically forms a series of shelves when placed on the inside, which go far toward causing the arching of lump coal above referred to. It is a little thing, but locomotive operation is made up of a series of little things. Sometimes the loss of a cotter key results in an engine failure.

The location of a coal gate at times also affects locomotive operation, as, for instance, if the coal gate is located immediately above the crushing zone in the stoker conveying mechanism, it is a hard matter to exclude tramp iron from the coal. If the tender is fully loaded and a piece of tramp iron too large to pass through the crusher happens to feed into the coal, it is often a difficult matter to remove the obstruction where the coal gate is located too far ahead. The amount of coal space sacrificed by placing the coal gate a little further back, or at least angling them back at the center, is negligible compared with the possibility of overcoming train delays due to tramp iron getting caught in the crusher.

Special fire hose coupling

IN the first-hose couplings commonly used on switching locomotives and fire-fighting equipment, the hose is held in the coupling by a thin, expanded ring, With this type of coupling, it is not unusual for the hose to



A fire hose coupling designed to prevent the hose from blowing out

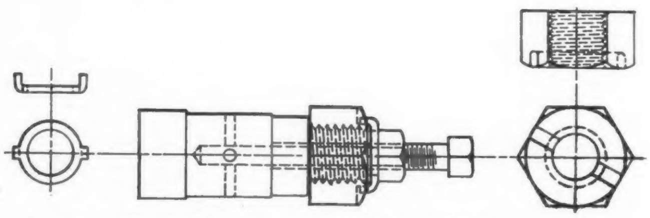
blow off under pressure. The coupling shown in the illustration is designed to prevent this trouble. It consists of an inner and outer part. One end of each is threaded on both the inside and outside circumferences. The opposite ends are tapered 3 in. per foot, thus forming two cones. One end of the hose is placed between these two tapered surfaces and when the two parts are drawn tight, the hose is firmly gripped between the two cones. Vee-shaped grooves are cut in the inner surface of the outside cone which grip the hose, thus providing an additional precaution against the hose blowing off. This coupling has never failed under a pressure of 300 lb.

Method of locking crosshead pin nuts

By W. T. Speak

Foreman, Louisville & Nashville, Louisville, Ky.

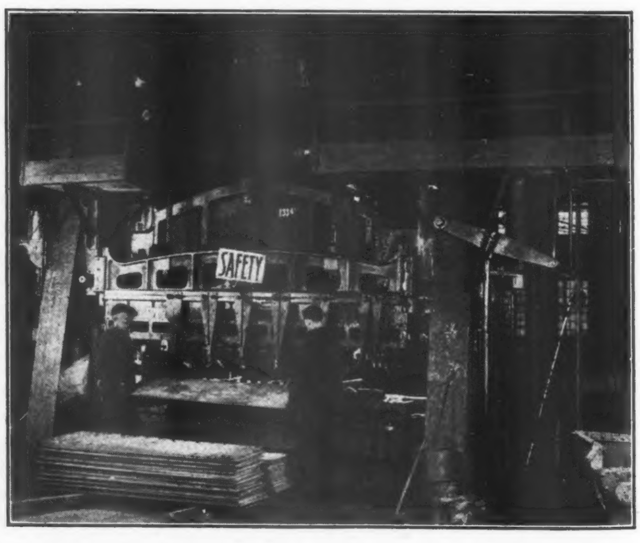
MANY locomotive failures have been caused by the crosshead pin nut becoming loose and eventually working off the end of the pin. The illustration shows a method of securely locking the nut in place on a crosshead pin in which hard grease is used as a lubricant. A slot is machined in the top of the nut. A steel



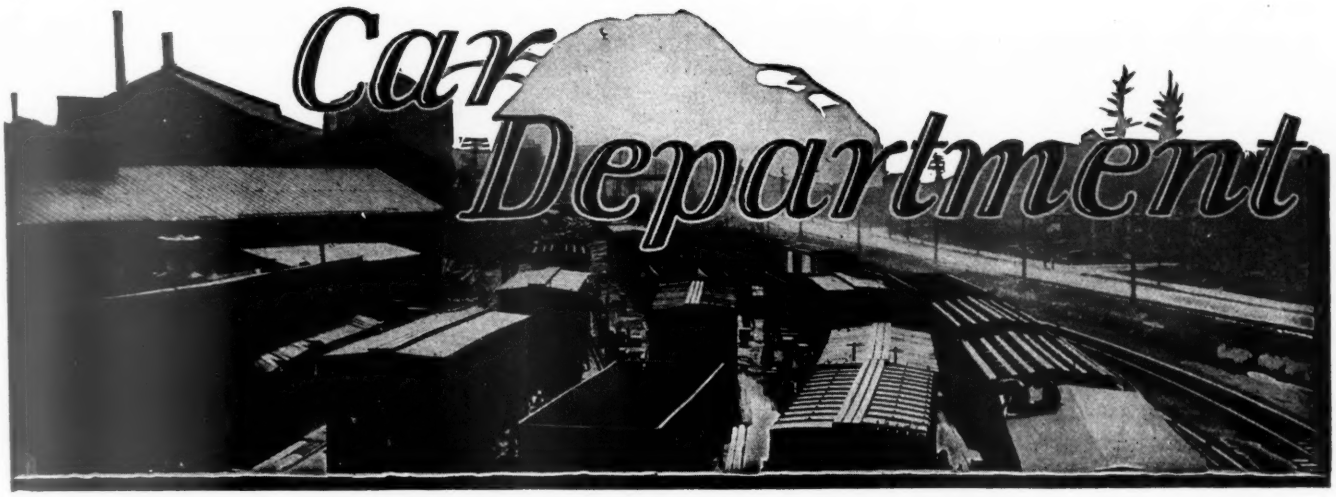
An arrangement for securely locking crosshead pin nuts

washer provided with two fins which fit in the slot on the nut is then put in place on the nut. The threaded hard grease plunger is screwed into the crosshead pin the desired distance. Then the plunger nut is tightened against the steel washer. This last operation depresses the steel washer, thus causing considerable pressure on the crosshead pin nut and against the plunger nut, which prevents both nuts from becoming loose.

* * *



Multiple punch at the Berwick, Pa., plant of the American Car & Foundry Company—Shown at the March 16, 1928 meeting of the New York Railroad Club



Additional proceedings at Car Supervisors' convention

Efficiency of car shop operation, question-box report and interchange rules discussed

FOLLOWING the presentation of the paper, "Higher maintenance of freight equipment to reduce terminal delays," by L. R. Wink, assistant superintendent car department of the Chicago & North Western, as reported in the October issue of the *Railway Mechanical Engineer*, the members of the Master Car Builders' and Supervisors' Association, in convention at St. Louis, Mo., September 11 to 15, inclusive, discussed the subject at considerable length. One of the features most strongly emphasized was the problem of "spongy" floors in automobile cars, the discussion being started by the statement that 1,000 automobile cars were recently held at one time in Michigan largely for floor repairs before the shippers would load them with automobiles. While the repairing roads were repaid for material and labor, they lost per diem on these foreign cars, and in self defense they now reject automobile cars at gateways when the floors are not repaired so as to be in 100 per cent condition.

Careless use of screws and nails by shippers

While two members criticised the use of an excessive number of nails and lag screws carelessly driven by shippers and more carelessly removed by dealers, the consensus of opinion was that the shippers have just cause for complaint when automobiles loaded in accordance with A.R.A. rules break loose in transit due to "spongy" floors, the result being damage claims and, often more serious from the shipper's point of view, loss of sales to competitors. The facts seem to be that, with the present method of loading, a new car floor is required for almost every loading of automobiles, and something must be done to obviate this expense.

On motion of S. O. Taylor, master car builder of the Missouri Pacific, a committee was appointed to study the matter and report at the next convention of the Master Car Builders and Supervisors Association.

Efficiency of car shop operation

By B. J. Huff

Efficiency Supervisor, Chicago & Eastern Illinois, Danville, Ill.

THE efficiency of any shop can be determined only by the results obtained. This cannot always be determined by the number of cars repaired monthly, but by the amount of work performed on these cars, the quality of the work performed, and the cost of performing same. The efficiency of car shops should, therefore, not be wholly a matter of conjecture, but should be definitely determined from comparative production and cost figures.

Shop tools and equipment

Shop tools, machinery, and equipment must be given careful consideration in the shop or repair track at all times, if efficiency is to be obtained. In most shops the workman is required to equip himself with certain tools peculiar to his class of work, and other essential tools are generally furnished by the railroad company; regardless of the manner in which these tools are secured, it is important that he have certain essential tools, and each shop foreman should know that workmen under his supervision are equipped with proper tools for the class of work they are required to perform. Regular inspection of tools should be made to see that they are maintained in good condition and that each workman has a sufficient supply.

Proper study of methods of performing work and types of machines used should be made to assure that work is being performed using the cheapest and best method available. The large investment made in tools and machinery makes it necessary that the requirements be analyzed thoroughly and systematically. Statements showing estimated savings by the installation of new tools and machinery should be furnished from actual checks of the work performed. New methods and tools are being introduced at all times, and in many cases investment in new or modern machinery

will be offset by increased production and the quality of work. For example: Two portable riveters were purchased by the Chicago & Eastern Illinois sometime ago, for use in rebuilding 2,000 coal cars. These riveters approximately doubled the output per man hour, decreased the cost of driving .008 per rivet, and also gave us a much better grade of work than could have been performed with a pneumatic hammer.

Another example of efficiency and reduction in operating expenses was demonstrated by the railroad with which I am associated, as we recently modernized our wheel shop machinery, installing one double head axle lathe, one journal-truing lathe, one modern wheel lathe, two boring mills, and one double end press, in place of the following old type machinery; two single head axle lathes, one double-head axle lathe, one wheel lathe, three boring mills, and two single end wheel presses. A check of results later fully supported our original estimates submitted to the management in promoting this change, figures indicating that our wheel shop force was reduced 36 per cent and a corresponding reduction made in the cost of operation. As an example, where we formerly were forced to dismount wheels for truing journals, the installation of a modern journal, truing lathe, permitting the truing of journals without dismounting wheels, resulted in a saving of 82 cents per pair of wheels having journals turned. These are only examples of the possibilities of savings by the installation of new or modern machinery.

Investigation of shop practices of other railroads by supervisors will be of great assistance in developing closer co-operation and better methods of performing work.

Material and supply

While it is important that investments in material be curtailed and reduced to a minimum, it is just as important that sufficient quantities of standard material be furnished so that the work may not be delayed. The stores department should, of course, be advised of all proposed heavy repair programs, or changes in same. In order that a shortage of material may be handled promptly, a weekly material shortage report is required from all our shops, on which all material needed is listed in three classes, according to the degree of need. Material for which cars are being held on shop tracks is shown under Class 1. Material which is badly needed and the supply is exhausted, but cars are not being held on repair tracks on this account, or other material is being substituted or manufactured in local shops, is shown under Class 2. Items of material of which the supply is running low are shown under Class 3.

If the workman is to be efficient, the material must either be delivered to him promptly, or it must be located at supply depots as near to the repair tracks as possible. The material required for general repair cars is delivered to our men by a supply gang, while on most of our light repair tracks the workmen deliver most of their own materials, for which they are paid additional on the piece work schedule. By this method, the numerous delays for material on light repair tracks are eliminated. The provision of small supply depots along repair tracks for certain kinds of material, in some cases, will reduce the time required for delivering material 50 per cent. Workmen assigned to piece work, co-operating with supervisors, have made some valuable suggestions as to the location and kind of material to be carried at these small supply depots. If actual time checks are made for certain operations, it will be found in some cases that the time required for getting some items of material is greater than the time required to apply same, due to the location of supply depot.

Conservation of material

Care should be taken by the foreman to see that no serviceable material is removed from cars and destroyed, that material is reclaimed where possible, and that proper care is taken by the workman to save material. In order to insure a careful inspection, we require that the work of repairs must be authorized on the piece work or original record card, before the work of repairs is begun, showing the actual amount of new material required as far as it is possible to determine at that time. Each car is again inspected after repairs are made to see that work is performed properly and that new material was applied as ordered. Piece work prices, covering removing and replacing items of material requiring special care for removal, have been made with the idea of encouraging the saving of old material. The gang foreman should be furnished with information showing the approximate cost of repairs to various classes of cars, and the cost of the principal items of material used, to increase his interest in saving material.

Shop records

The records required at all points must, of course, comply with the requirements of the American Railway Association rules, and all records should be made as simple as possible. Our piece work cards on all cars are a record of work authorized and performed, and show whether items of material check in connection with piece work are renewed, removed and replaced or repaired.

In addition to this record, an individual car record is maintained on all general repair cars. This record is kept on a printed form, on which is shown the principal items of material and the total actual labor charges on each car. These records are filed in the office of the superintendent of car department in number order, and records are compared when cars again receive general repairs. This record not only furnishes an accurate record of work performed and total actual labor costs of each individual car, but also furnishes valuable information for determining the policy of maintaining various classes of equipment. By a careful analysis of these records, the need of certain reinforcements or changes in the construction can also be determined. These records likewise furnish a basis for determining the cost of maintenance of each series of cars for general repairs, the average life of each series of cars being given general repairs, and the cost of maintenance of general heavy repairs.

Classification and training of men

In order to provide for the training of men in the freight car department inexperienced men are employed as helpers and a definite ratio of mechanics and helpers is maintained on the various classes of work performed. When men are first employed, care should be taken to see that they are assigned to positions according to their previous experiences, as far as possible. All men working on piece work are paid according to their hourly rates. The mechanic, who is working piece work, is always personally interested in developing the efficiency of his helper, because his piece work earnings are partially dependent on the ability of the helper. The helper, who is also assigned to piece work, is personally interested in developing his efficiency, and

on account of this personal interest, and the supervision of the mechanic, he will soon develop his ability as a mechanic. When higher rated positions become vacant, which the helper is capable of filling, he is considered in preference to men who are not already in the employ of the company.

Spot system

It is generally conceded that the progressive method, or "spot" system, is the most efficient method to be used in the repairs to our rebuilding the cars, where the daily output is large enough to justify its use, whether the men are moved from car to car or the cars moved from station to station. By its use, the foreman is able to develop the highest efficiency and classify his men according to their ability. It also reduces the cost of delivering and handling material, and reduces the number of special tools required, and permits special training of men using and caring for same.

The Chicago & Eastern Illinois recently rebuilt 2,000 cars in its Oaklawn shop, using this system. The bodies of the old cars were stripped and underframes cut up for scrap on separate tracks. These cars were assembled at the rate of five per day on one stub end track in twelve working positions, the cars being moved from one position to another by the workmen.

The work on these cars was classified as follows:

Stripping car body and cutting up underframe for scrap
Dismantling trucks
Assemblying trucks
Fitting up and reaming steel parts at bench
Driving rivets with pneumatic hammer at bench
Fitting up steel parts on car body
Reaming holes for riveting
Riveting steel parts with pneumatic hammer on car
Riveting steel parts with gap riveter at bench and on car
Applying air brakes complete
Applying steel doors
Applying floor
Applying side and end plank
Spraying car body, trucks, and underframe
Stenciling car

This method had a great advantage on account of this classification of work. Mechanics and helpers who are often below the average on heavy repairs, when work is not classified, with few exceptions, become very efficient on positions where they are best adapted to work.

Production

We are all familiar with the various methods used for getting production from the workman; the day work system, probably most commonly used, on which the amount of work performed depends entirely on the supervision and judgment of the foreman, and the willingness of the workman to perform a fair day's work; the day work system, on a production basis, where a definite task is assigned to each man to perform, or where certain checks are made to determine the efficiency of the workman; the piece work or bonus system, whereby the workman is paid according to the amount of work performed. The latter system is the one used by the Chicago & Eastern Illinois in a majority of its shops in the car department.

Our piece work schedules are based on what we consider the production of an average workman working day work. This is a very important factor in piece work, as efficiency is often affected and dissatisfaction created by establishing piece work schedules on the production of the best workman, thereby depriving him of increased earnings, which he should enjoy on account of his natural ability and interest in his work. The hourly rate of the workman is given the same consideration on piece work as it is on day work, each workman being paid on piece work according to his hourly rate.

Piece work schedules should never be installed until careful time analysis has been made of the various items of work and comparison of cost on piece work versus day work has been made. This in itself will be of great benefit in eliminating many unnecessary delays, such as waiting on material, insufficient tools, or improper methods of performing work. In other words, the installation of piece work will bring about a more thorough study of all the factors which should be considered for the efficiency of the shop which I have mentioned before, such as shop tools and machinery, material and supply, etc.

The time required by the foreman for personal supervision of his men to keep them busy will be reduced, and this can be diverted to more thorough inspection of cars or other work before and after repairs are made, and on account of the detailed and systematic inspection required, a better quality of work is insured.

The work of repairs is expedited where men are working on piece work, thereby reducing the delay to freight and equipment on repair tracks to a minimum.

Piece work also provides a good method for accurately determining the efficiency of the individual workman or shop. The local foreman is sometimes criticised unjustly for the efficiency of his shop on day work, but he has no actual figures to show the efficiency of his shop. Piece work also insures a balanced force at all times of the actual number of men required for the work being performed at each point.

Another reason why piece work is successful is that it creates a personal interest in every ambitious workman, because he is being paid according to his ability, as compared with his fellow workman, and the standard is raised to the best workman instead of to the poor workman, as it sometimes is on a day work basis. When assigned to piece work, the workman immediately eliminates all possible delays, and many times figures out new methods for performing the work and suggests to the foreman ways in which the work can be expedited. As a result of this personal interest, many inexperienced and inefficient workmen soon develop into good mechanics. If piece work is to be really successful, the average workman must be able to make more than his hourly rate in accordance with his increased effort over day work. If the workman is able to increase his hourly earnings, we will receive his hearty co-operation, and he will be better satisfied.

Discussion

There was an animated and extended discussion of the advantages of day work as compared to piece work, the majority opinion apparently being that at large car repair shops the combination of the progressive system of car repairs with the piece work wage system is most conducive to efficiency, piece work without the progressive system being best at smaller repair points. There were numerous adherents to the day work system on a production basis, however.

One member said that piece work tends to promote dishonesty, and another countered with the expressed opinion that proper inspection will prevent any tendency in this direction. The latter also raised the question if it is not dishonest under the day work system for one man capable of 25 per cent greater production than another to restrict his output simply because his pay is no greater than that of the less efficient workman.

Referring to the fact that the use of the piece work system of wage payment tends to facilitate placing men

at work for which they are best adapted, another member said that piece work has made some very good employees out of some who were not so good. He also said that, in his opinion, it makes poor employees out of some who were formerly good.

Mr. Huff's remarks regarding material handling and shop machinery met general approval.

Question box report

THE report of the Question Box Committee, including both questions and answers, was read in part by B. F. Jamison, special traveling auditor of the Southern, Meridian, Miss., and in part by G. K. Oliver, passenger car foreman of the Chicago & Alton, Chicago. The committee desired to have it thoroughly understood that the answers were not official in any way, but simply the committee's interpretations of the rules submitted for such helpful information as they might contain.

A total of 42 questions were submitted, but of these the last seven were held over until the next convention due to lack of time for their proper consideration. The discussion centered around questions 1, 10, 12, 18, 24 and 34, questions 18 and 24 being referred back to the committee for further consideration.

Question 1

1—*Q*—Does the application of A. R. A. wrought iron bottom connection rod in place of Schaefer bottom connection rod constitute wrong repairs?

A—No; provided A. R. A. standard brake connection is used.

T. S. Cheadle (R. F. & P.): The only question in my mind is that the last word in the answer would be better if it were "proper." I mean to substitute the word "proper" for the word "used" in the answer to Question 1. The question is answered correctly with that one word put in there. They must have in mind that the A. R. A. standard for rods would not be proper, and in that case I suppose you would use the owner's standard. I don't see what else they could have in mind, and if the word "used" were "proper" it seems to me the question would be answered more understandingly than it is.

E. S. Swift (Wabash): I think the answer as intended by the committee was that the wrought iron rod in place of the Schaefer rod would not be wrong repairs providing the wrought iron applied was A. R. A. standard.

Questions 2 to 9

2—*Q*—*Statement*—Rule 32 provides, that damage to any car caused by handling of cars with broken or missing couplers or couplers out of place, is handling line responsibility.

Question—If a coupler falls on the track and damages one or more brake beams in the same train, is the handling line responsible for this damage under this Rule?

A—No. Owner's responsible. See interpretation 9, Rule 32.

3—*Q*—If a 5¼-in. by 10⅝-in. axle is removed on account cut a journal, turned to 5⅛-in. by 10⅛-in., and replaced, should a defect card be applied for scrap axle?

A—Question returned to party on account of being mechanically impossible to perform the operation as detailed.

4—*Q*—Is a Cardwell spring rod A. R. A. material?

A—Yes. See Interpretation 1, Rule 101, page 127.

5—*Q*—Referring to Rule 95, is a wood block in place of a complete friction draft gear missing a cardable defect in interchange?

A—Yes. See Interpretation 4, Rule 88, page 106.

6—*Q*—If our repair card covering coupler renewed bears the statement "Wrong repairs", is joint evidence necessary before the owner can demand a defect card for wrong repairs?

A—Joint evidence should be executed. However, if the repairing line acknowledges that they made wrong repairs they should protect the owners. See Interpretation 4, Rule 87.

7—*Q*—Does labor charge for coupler and gear R. & R., per Rule 107, Item 122-A, include labor for vertical pin R. & R. per Item 115?

A—See Supplement 1, effective 8/1/28. Item 122-A, eliminated vertical pin included in Item 117.

8—*Q*—Are a bent brake pipe, truck sides scarred by sliding on rail and slivers from crossing planks on the wheels sufficient indications that two brake levers and bottom rod were missing on acount of derailment, the brake beams themselves being O. K.?

A—If an investigation develops no derailment, the owners are responsible.

9—*Q*—Two brake beams, found bent inside car, were renewed; there was no record of unfair usage; six days later the receiving line cards for one inter sill broken on acccount of derailment. Should a charge for brake beams be cancelled?

A—No; unless brake beams were damaged under Rule 32 conditions.

Question 10

10—*Q*—If a tank car has a shifted tank, and repairs are made and the car is accepted O. K. by an intermediate line, should a charge for repairs be cancelled if the owner finds the tank shifted when the car arrives home?

A—No; if proper repairs were made.

C. J. Nelson (Chicago Interchange Bureau): Fearing a possible misunderstanding with regard to Question 10, I should like to ask the committee just what they had in mind in connection with their answer. As I understand it, this is a case under Rule 44, and if that is true, it would seem as though the committee intended to convey the fact that the car owner is responsible.

Mr. Jamison: I do not think that it was the intention of the committee to convey any such impression. The tank car owner would have a perfect right under Rule 44 to demand a statement accompanying his bill, but if a few days later the car arrives home and the tank was shifted again, that would be no reason why the bill in the first instance should be withdrawn, unless there was evidence that proper repairs were not made, such as the use of the wrong kind of bolts. I think the committee's answer is correct.

Mr. Nelson: I just raised the question because it is a very important one. You are no doubt aware of the difficulties we have in cases under Rule 44.

Question 11

11—*Q*—Does Rule 108, which prohibits a charge for either labor or material in applying "spring cotters or split keys, under all conditions," apply to coupler release levers R. & R. or R. per Rule 107, Item 254-A?

A—Yes. Item 254-A, Rule 107, gives an arbitrary labor charge of 2 hours for R. & R. or R. of lift lever.

Question 12

12—*Q*—If the load limit per Rule 86, is not changed in accordance with a new light weight, should the entire charge for weighing be cancelled on account of violation of Rule 30, Section (g)?

A—If failure to change load limit necessitates reweighing the car, the entire charge for reweighing car should be cancelled. If not reweighed, credit should be allowed per item 419-B, Rule 107.

James Mehan (Milwaukee): I am wondering where the Question Box Committee got the authority to say that that bill should be cancelled. There is nothing in the rules today to warrant such a ruling or such an answer. I suppose if the question were ever ruled on officially, it might be ruled just as this committee has ruled, but I think it very dangerous to set out a ruling of this kind that wouldn't be accepted as authoritative without an official ruling.

Mr. Oliver: The answers to questions here are

only the opinion of the members of the Question Box Committee and are presented only for constructive criticism and correction if necessary.

Mr. Nelson: I believe that it is a well understood fact that any of these questions that may be answered are intended only as an interpretation of the rule as the committee understands it.

Certainly we must exercise our best judgment in carrying out the spirit of the rules on a common sense basis, and while there may be something to what Mr. Mehan said, I don't think we are in any way infringing on the authority of the Arbitration Committee or anyone else by following what seems to be the opinion of this, I should say, very wise committee. I am very much in favor of letting the question and answer stand just as it is.

Mr. Oliver: In making the answer the committee gave on this question, the whole subject of the question was that the work was not completed, making it necessary to do the work over again. Therefore, the work being incomplete was wrong repairs. The car owner should not be compelled to pay the bill twice, and the line that did the work properly should not be penalized by having their bill withdrawn. The man who failed to do the work in the first place should not receive compensation for the work performed.

Questions 13 to 17

13—*Q*—If the load limit, per Rule 86, is not changed in accordance with the new light weight is joint evidence necessary to establish the repairing line's responsibility?

A—Yes.

14—*Q*—On page 134, under "Weights of Draft Springs," the first four items are shown as A. R. A. springs. Are the other springs shown in that list also A. R. A. springs?

A—No; except Cardwell G type, Class 23.

15—*Q*—Referring to Rule 17, Interpretation 24, should new or second-hand credit be allowed for the cast steel yoke removed when not defective?

A—Credit should be allowed on pound basis, per Item 114, Rule 101.

16—*Q*—If a car is reweighed 10-1-26, at which time there was no load limit stencilling on the car, is joint evidence that load limit was not changed valid?

A—Yes. Joint evidence is final, Rule 12.

17—*Q*—Is an additional labor charge for brake hanger key bolt or pin permissible in connection with renewal of brake beam?

A—Yes; if the brake hanger key bolt or pin is defective or missing. Item 45, Rule 107.

Question 18

18—*Q*—Is it wrong repairs to apply an A. R. A. standard 5-in. by 7-in. by 6½-in. (or 9⅛-in.) butt and an A. R. A. standard 1¼-in. by 5-in. riveted yoke in place of a 5-in. by 7-in. by 8½-in. butt coupler and 1-in. by 5-in. riveted yoke standard to car? (See Rule 17, Section "a".)

A—No; providing draft arrangement will allow proper application.

(Referred back to committee for further consideration in view of conflicting opinion.—EDITOR.)

Questions 19 to 23

19—*Q*—If a wooden underframe car has three new sills broken and three old sills broken, must a statement be furnished the car owner or are the old breaks classified as "other old defects" as stated in Rule 44, Section (I)?

A—Statement must be furnished as per Rule 44.

20—*Q*—If air brakes are cleaned February 1, 1928, and are again cleaned on account of being inoperative by another road April 1, 1928, must charge for repairs 2-1-28 be cancelled?

A—Yes. Second cleaning is done on the sixtieth day.

21—*Q*—Is a bent sill step or a bent grab iron on a tank car running board a cardable defect when there are indications, but not positive evidence, that the car was cornered? (See Rule 33, Interpretation 2, and arbitration Case 954.)

A—The owners are responsible if the car is not damaged under Rule 32 conditions.

22—*Q*—Should a car without any light-weight stencilling be weighed during rain, snow, sleet or heavy winds? (See Rule 30, Section "c").

A—Yes. Considered parallel to Paragraph 8, Section F, Rule 30.

23—*Q*—If a foreign line reweighs a car which has no load limit stencilling, may the load limit be stencilled in accordance with the new lightweight and Rule 86, the owner evidently having failed to stencil the car with load limit?

A—No. See the first and second paragraphs of note under Section H, Rule 30.

Question 24

24—*Q*—Is it wrong repairs to apply a pair of wrought-steel wheels on axle with 5-in. by 9-in. journal in place of cast iron wheels with same size axle?

A—No. See Rule 70 and Interpretation 1, Rule 70.

Mr. Mehan: I suggest that the answer to Question 24 be reversed because Rule 70 does not give you the authority to apply a wrought-steel wheel to a car to take the place of a cast-iron wheel.

Mr. Oliver: I don't believe there is anything in Rule 70 that says you can't use a wrought-steel wheel. There is something that says you can't charge for it if you do use it.

Mr. Mehan: Rule 70 does specify the kind of wheels that may be substituted by wrought steel and it doesn't include cast iron for some reason or other, and I think the reason is you can't apply one A. R. A. standard to a car owner's car and assess him for it when he is doing all he can to comply with the A. R. A. standards.

W. J. Owen (P. & P. U.): I can heartily support Mr. Mehan. As I understand it, you have no right to substitute wrought iron wheels in place of cast iron wheels under cars of 100,000-lb capacity or less, but you do have that right under 140,000-lb capacity. You have the right to substitute wrought iron wheels in place of cast steel wheels on all cars of any capacity, because the wrought iron multiple wear wheel is an A. R. A. standard wheel and the cast iron wheel is a standard A. R. A. wheel under cars of 100,000-lb. capacity or less.

Mr. Nelson: I can't by any stretch of the imagination see how any car owner would or could object to getting a pair of wrought steel wheels in place of a pair of cast iron wheels, and it is my opinion that the demand for wrong repairs will be so far apart that there will be absolutely no danger involved in allowing this question and answer to stand as it is, and I recommend that we proceed.

C. C. Hennessy (Big Four): I don't like to see the answer to Question 24 passed up as it is. "Is it wrong repairs to apply a pair of wrought steel wheels on axle with 5-in. by 9-in. journal in place of cast-iron wheels?" That answer, to be right, should read: "It is wrong repairs, and a defect card should be attached to car covering."

You can bill for wrong repairs to the car owner to be reimbursed by or through a defect card you put on the car. If that was a 6-in. by 11-in. journal, the answer would be all right and it would not be wrong, but with the 5-in. by 9-in. journal, it is wrong repairs.

Mr. Nelson: Mr. Chairman, in order to expedite the matter I am willing to appeal to you under parliamentary rules. I think the question is out of order and that we should proceed.

Secretary Sternberg: Inasmuch as there was some dissension and difference of opinion on Question 24, and rather than leave it standing as it is, I should like to make a motion that it be referred back to the Question Box Committee for further consideration.

Mr. Nelson: I second the motion.

(*The motion was put to a vote and was carried.*)

Questions 25 to 32

25—*Q*—If a coupler with vertical pin is standard to a car and a type D coupler with vertical pin (all other specifications being A. R. A. standard) is applied, should car be stencilled "A. R. A. Type D Coupler?"

A—No. Not A. R. A. standard.

26—*Q*—Rule 107, Items 55 and 305. What is the proper labor charge for one 8-ft. brake chain and two 5/8-in. by 2½-in. brake chain bolts applied at the same time a brake rod sheave wheel is applied?

A—The proper charge is .7 hrs. Each operation independent of the other.

27—*Q*—Rule 108, Section B, states no labor or material shall be charged for wood screws (other than lag screws), except where six or more are applied. Is it proper to combine charge for screws when four are applied at A end and four are applied at B end in separate pieces of running board, thereby making a charge of eight screws?

A—Yes, if applied at same shopping of car.

28—*Q*—Rule 101, Items 171 and 107, Item 230, also Rule 111, Item 4, Note and Item 23. What is the proper labor and material charge for two retaining valve lag screws applied?

A—Charge for labor and material should be 21 cents, per Item 23 and note under Item 4 of Rule 111.

29—*Q*—Rule 2, Section F, Item 2. Should transfer authority be issued for a loaded car in interchange with a Vulcan oil box broken; also does this oil box constitute a non A. R. A. standard?

A—Transfer authority due on foreign cars. Non A. R. A. standard oil box.

30—*Q*—Rule 107, Items 90 and 116. What is the proper labor charge for ten draft pan bolts 5/8-in. by 2-in. applied at B end?

A—One and 2/10 hours per Item 116, Rule 107. Also see note following Item 87, Rule 107.

31—*Q*—A car is received home properly carded for entire superstructure above the floor missing. When car is reweighed and stencilled, is it considered a per diem or non per diem car when on home line?

A—A charge of $4.15, per Item 419-A, Rule 107 is proper for reweighing and restencilling all per diem cars regardless of whether on foreign or home rails.

32—*Q*—Rule 101, Items 178, 179, and 180. These Items show prices for pipe on the foot basis. On what basis should charge be made for 13-in. of pipe?

A—One and 1/12-ft. at the rate shown in Item 178, 179 and 180, Rule 101, plus 2 threads cut per Item 28, Rule 111.

Question 33

33—*Q*—Rule 107, Item 237-A. Should a charge be made for a body truss rod nut at A end, when the end sill is applied at the B end?

A—No. See Note under Item 42-B. Rule 107

R. Vineyard (M-K.-T.): In connection with this I should like to call your attention to Item 237-A of Rule 107 which provides for a labor charge of .4 hrs. for the application of this item. This item also provides that no reduction will be made for turn-buckles as A. R. A. standard and it is my contention that the note under Item 42-B of Rule 107 does apply and that you are entitled to your rate charge for body truss rods.

Mr. Swift: I haven't the item here, but I believe it refers to "one or more on the same rod, .4 hours." If it is necessary, of course, to take the one truss rod nut off and slacken the other, you couldn't charge for one and it would naturally cancel the charge for the nut on the other end of the rod. The item says, "one or more on the same rod, .4 hrs."

The item you have reference to refers to Rule 107 and that is for labor. It doesn't say anything about material. That is the reason it was interpreted in the, manner shown.

Question 34

34—*Q*—Rule 2, Section F, Item 7. Should transfer authority be issued in interchange for a loaded car with any or all inside metal roofing in a defective or missing condition contents of car subject to be damaged by rain?

A—Yes.

Mr. Nelson: Fearing that this question might have been put by a car man located at a point other than a large terminal, I am somewhat alarmed about the possibilities of misinterpreting the answer. The answer in itself, is, in a measure, correct, but if it is agreeable to the committee and to the members here, I should like to suggest adding the words "Except when repairs can be made without undue delay or damage to lading."

Mr. Owen: I second that motion.

(*The motion was put to a vote and carried.*)

Question 35

35—*Q*—A foreign car is received in shop, defect carded for one pair of slid flat wheels at R. & L.-1, and at the same time a Vulcan truck side is removed, repaired and replaced at Location R-1 and R-2. What is the proper labor to be charged the car owner for removing and replacing the truck side? The truck side was only repaired.

A—Total charge for all repairs mentioned 6.8 hrs., plus 1 hr. for jacking as per Items 485 and 496 of Rule 107. Divided as follows: Charge 4 hrs. for change of wheels and 1 hr. for jacking, covering renewal of wheels against defect card: charge 2.8 hrs. against owner for labor to R. & R. truck side for repairs.

Report and discussion on A. R. A. rules

Chairman G. W. Moore (Frisco): It has been recommended that we take Supplement No. 1 to the A. R. A. Rules of Interchange and read each item, passing on it as we go along. I shall ask the chairman of the A. R. A. Committee, G. K. Oliver (C. & A.), to please come forward and read the rules.

(Mr. Oliver read Rules 2 and 3)

Rule 3

T. S. Cheadle (R. F. & P.): I should like to ask one question, Page 4, Paragraph 2, regarding 6-in. by 8-in. couplers on cars rebuilt after July 1, 1928. Does that mean regardless of how much you spend on the car or how much of the car is rebuilt or renewed, you can't re-stencil it "rebuilt" until you put on a 6-in by 8-in. shank coupler?

C. J. Nelson (Chicago Interchange Bureau): I may be wrong, but it is my personal opinion that it would be asking a great deal of the chairman of the A. R. A. Committee to pass on important questions of that kind. I believe there is considerable misunderstanding in connection with this question of a rebuilt car and I doubt that we are in a position to analyze and decide these questions on this occasion.

I believe, however, just expressing my personal view, that this requirement Mr. Cheadle referred to, refers probably to these rebuilt cars as outlined in the recent circular published by the American Railway Association.

J. J. Gainey (Southern): According to the reading of this rule, a rebuilt car is one that you write out and write back in again, and when you do that you must apply that coupler if you class it as a rebuilt car.

C. M. Hitch (B. & O.): I can only agree with what Mr. Gainey and Mr. Nelson have said. I think what constitutes a rebuilt car is a very important question, and as Mr. Nelson said, I don't believe this body here can decide that. However, Mr. Gainey said that so far as he can get out of the rules, the rebuilt car is a piece of equipment that is written off the books and brought back on the books at the new value after it is rebuilt, and it has to be recorded by the American Railway Association in order that they may know it is a rebuilt car.

Mr. Nelson: It would be interesting to get an expression from the gentlemen here, and in order to bring that about I move that it is our opinion that this provision of Rule 3 refers to a car considered rebuilt under the regulations.

Mr. Hitch: I second the motion.

Chairman Moore: It has been regularly moved and seconded that it is the opinion of this body that the rebuilt car would be classed the same as the new car and it would be necessary to apply the 6-in. by 8-in. shank coupler.

(The motion was put to a vote and carried.)

J. H. Eddy (Central of New Jersey): Referring to Paragraph 6, there are numerous types of direct lifts with a coupler lock and I believe that any one will meet the requirements of the rules. If a carrier should apply their standard, it should meet the requirements and no exception should be taken, because there is no necessity of changing it until you have to make alterations on the coupler or lift, and then if you want to make it standard you can do it at your own expense.

D. E. Bell (Can. Nat'l): Our road has had a lot of trouble with private lines over this question, and as I interpret Rule 88 it should apply to labor charge only. In some cases the total material cost is eleven cents and they cost about $5 to handle.

(Mr. Oliver read Rules 11, 17, 24 and 26.)

Rule 26

B. F. Jamison (Southern): I presume that there are others besides myself who would like to know something more about the rules than we are able to draw from them. The language of this last one seems to leave room for a question in the first paragraph, "the renewal to be confined to the defective bar or bars," while in the last paragraph it reads: "Scrap credits shall be allowed for undamaged parts thus removed."

The question has been asked repeatedly: If we have a bottom bar broken, or one side of one truck, shall we renew both the top bar which is not broken, and the tie bar? The question is: Is that what is referred to when they say "Scrap credits shall be allowed for undamaged parts thus removed." If that is what the rule intends, then why use the last line of the first paragraph, "the renewal to be confined to the defective bar or bars."

W. J. Owen (P. & P.U.): The last paragraph refers to undamaged parts, which are bolts, when you remove them without damaging them. If you have a bottom arch bar broken, the rule plainly states that you must confine your renewal to the bar that is broken; therefore, you are unable to remove the top bar and renew it. You should confine your work to the broken bar, and it is not necessary to remove or renew the bottom tie strap. You should either turn up the gibs on the bottom bar that is renewed or put a pin in, welded, or spot welded with electricity, or put a rivet in 1⅛ in. or 1¼ in. in size. You are allowed 50 cents, I believe, for the first rivet, the same as in the riveting prices, and 20 cents for the second rivet.

There is no price for removing the top bar, taking it to the drill-press and drilling it, but I think you are compensated for your trouble by the units or for welding it in. The rule plainly states that you must confine it to the broken bar.

J. A. Truesdale (St. Paul, Minneapolis): I can't go along with Brother Owen in his statement that it is not necessary to apply the gib. My understanding of that rule is that we must apply the gib and also the pin or rivet. I believe this rule plainly reads that way. The diagram which I wanted to refer to states "Turned-up ends optional. Designs No. 1, 2 or 3 may be used."

Mr. Cheadle: The question as I understand it is as Mr. Owens explained, but I am wondering what kind of a job we are going to have when we get through with it. It will be terrible and we will have terrible cars.

The question I had in mind was that in a great many cases the top bar will be too long and it will have to be cut off, making an additional awful looking job. I wonder what can be charged for it, or should we do it at all.

Mr. Gainey: I think the rule is pretty plain for the greater part of it, and I agree with Mr. Owen. In answer to Mr. Cheadle, if the bottom bar is broken, if you put a bar back on there with a lip, the top bar is standard according to those rules. I can see no reason why you can't cut both ends off, fit it to the bottom bar and make a charge for the bottom bar.

M. E. Fitzgerald (C. & E.I.): I just don't go along with that argument very well. I can't connect the argument in connection with cutting off bars, etc., with this rule for the simple reason that the rule is clear and it indicates that there are three methods, any one of which may be pursued in repairs to cars on your rails. If you get a car on your rails with the bottom bar broken, there is no reason why you shouldn't turn up the ends of that bar. You can go right along and apply a bar of equal length to the present top bar, which is good, and rivet it or pin it. Then you don't turn it up. You don't affect the top bar in any manner only by drilling and applying the rivet. Therefore, there wouldn't be any necessity whatsoever for cutting off that top bar, unless you as the repairing line deem that Cut No. 1 was your standard method of applying the bar. It doesn't force you to do that; you have the other two methods which in no way affect the length of the old bar on the car.

I take it that the committee in giving us these optional methods took into consideration the fact that they had limited us to the renewal of broken bars and, therefore, we had to confine ourselves in repairs to a bar that would match up to the one on the car without a lot of unnecessary work for which they provided no labor charge.

Under No. 2, as I stated before, you are permitted to apply a bar of equal length with no trouble at all. I think if you will read the rule carefully it will not cause you a great deal of trouble and the cars will look as well as they ever did. One thing we are assured of, if we have a new bar under the car we have a little better application. That was the idea, and as long as we are confronted with the arch-bar truck I think we are going a long way towards safety by trying to comply with this rule and not making it too hard by jumping around and assuming that we are going to lose a lot of money and disfigure the appearance of the cars. You don't change the appearance of the car at all unless you look at the rivet.

R. Vineyard (M-K-T.): If you have a car that already has a bar applied on one side with a lip, naturally you would assume that the lip-type was standard on that particular car and you wouldn't want to apply another bar on the other side with a rivet. If you are renewing a bar and find that the top bar is too long to accommodate the lip bar, you would naturally have to cut it off. The gentleman was asking whether or not we should have a charge for that bar.

F. A. Starr (C. & O.): The rule plainly gives you three different methods of performing the work. Re-

gardless of the fact that the lip bar is standard on the car and it may be on one side of the truck, you are permitted under these rules to apply a bar with a rivet. I think we are making a mountain out of a molehill and assuming a lot of trouble that perhaps we will never come in contact with.

O. H. Clark (M. P.): We have placed the bars in that manner on several occasions. In some cases we found it necessary to cut the top bar off. Before that we made a charge of $1.70 per hundred, as outlined in Item 441, Rule 107. We have always applied that principle in cases of that kind. For instance, we get cars occasionally whose brake shafts are not drilled for cotter keys. We take those brake shafts off, drill the holes, and charge $1.70 a hundred, on the basis of Item 441. That is the same principle we would apply to cutting off a top-arch bar.

Mr. Hitch: One thing I have had in mind, was the question discussed here yesterday relative to fitting the coupler pocket gibs securely to the offset in the coupler. As we are going to put the gibs on the end of the bottom arch bar to strengthen conditions, it seems to me it is more important that the gib be properly fitted to the end of the top arch bar. If not, it is useless to put the gib on it. You have a variation of 1/32 in. and if you don't come within that dimension, your bill is null and void.

W. P. Elliott (T. R. R. of St. Louis): Suppose you have a car coming into the shop with both sets of arch bars bent on each side. Would you renew those and make them comply with those rules? Remember, they are just bent

W. M. Allison (D. T. & I.): I am glad Mr. Elliott asked that question as the matter was brought to my attention within the last ten days. We put out instructions on our road and took this stand: If both arch bars were bent, even though they could be straightened, in view of this Rule, if we would put back the same bars which were defective or which would become defective must be renewed as per the specifications, that We should put on the bar which is described by the A. R. A. instead of making the repairs to defective bars. I should like to know if it is the consensus of this body that my instructions are right on that.

Mr. Nelson: In order to expedite this question and get something definite on record, I move that it is the sense of this body that any arch bar that may be defective must be renewed as per the specifications, that any of the three optional methods provided in the cuts may be used, and that the renewals shall be confined to the defective member.

Mr. Jamison: I second the motion.

Mr. Fitzgerald: I believe Mr. Nelson is going to withdraw that motion. As I read Rule 26, it is rather clear. We are muddying the water. The rule starts off with "Where necessary to renew," and it says nothing about repairing. If you have a bar on a car that doesn't require renewal, I don't take it that you have to go ahead and change out the man's material and bring about this standard. They plainly confine you to renewals, not repairs.

On the other hand, going back to cutting off bars, I don't see where we are ever going to be confronted with that problem at any time. If you look at the cut carefully you will see that when you renew a bottom bar under No. 1, you extend it outward and bend it up over the extended end of the top bar, and if you look at it more closely and follow it clear across, you will see, if this is printed according to scale, that it indicates the top bar is identically the same length, whether it has the turned up gib or not, in order to extend the bottom bar outward and bend it up over the end.

The fact is, if we interpret this rule and study it over carefully it will not cause us any trouble. It is a safety measure, a good rule, and I don't believe that many lines will accept, if you do renew. I have no objection, but the rule doesn't give them that authority, and I don't think car owners will object greatly if you do follow this method in the case of a bent bar. You show it defective and bent beyond repair; go ahead and do it, and they will pay your bill.

Mr. Cheadle: I want to answer the question raised. Mr. Fitzgerald's position may be all right on his road. On our lines we handle perishable commodities and we carry in stock made-up bars for cars of certain roads. Necessarily we are not going to carry two kinds of bars, flat and turned-up gib. I think the gentleman who said they made a charge for such work would be justified. The question of cutting off bars, as raised by Mr. Hitch, is due to the fact that the bars are not even, and you will have a hard job if you don't fit them. You might as well not put a bar on.

Mr. Elliott: I should like to get clear on this because it is a very vital thing on a big switching line like ours. We have a good many bent bars in the course of a year and I should like to know what is the right thing to do. We would rather straighten them, of course, but we want to be right. Should we renew a bent bar or not? My opinion is that we should renew a bent bar because it is a defective bar.

Mr. Nelson: In defense of my motion, particularly regarding the bent arch bar, I just want to say that it was based on common sense. It seems to me that inasmuch as this rule was provided to reinforce the arch bar truck, we should take advantage of every opportunity to do that job, and it seems reasonable to assume that anyone would deem it good practice to perform the proper reinforcement when the car is on the repair track and you are dismantling the truck. I personally do not believe that any car owner in view of this rule would object to a bill of that kind.

Mr. Gainey: I agree a great deal with Mr. Fitzgerald here. I am still of the opinion, as I said before, that a great many roads are going to order their iron in lengths and they are going to order it to put the gib on. I still say that if the top bar is standard according to the rules, they have a perfect right to cut it off and fit it to his bottom bar and charge for it. My good friend over there said you can't make a job of it. You make a job of it when you make the new bars, and why can't you make a good job using the other bar?

In answer to Mr. Elliott, and we might as well be fair with one another, if that car has been in an accident and it has been derailed, you are going to straighten these bars and put them back on. There isn't any use of us getting up here and saying we are not going to do it because that is exactly what we are going to do.

There is only one thing, not quite clear to me. For example, we have a great many 80,000-lb. capacity cars with arch bars that this bar cannot be applied to. I want to know what they are going to do if they will try to put this bar on the 1⅛-in. by 6-in bar, and whether they can charge for it or not.

Mr. Bell: I was hoping that somebody else would raise two points I have in mind. Mr. Gainey touched on one of them, that is the question of the car which has different centers. On some of these cars there is a different drop from the top of the car above the

journal box to the bottom of the car. I should like to know whether it would be in order to use a bar of specified dimensions, that is, so far as thickness and width are concerned, and of course forge it in order to maintain the owner's standard so far as true wheel base is concerned.

Another point is the question of broken arch bars in derailments. When we apply the new A. R. A. standard, are we justified in charging for the betterment?

F. W. McGrath (Skelly Oil Company): My opinion of this matter is that if the car is derailed and the arch bar is bent, the railroad company is responsible, and I can't see where the private owner has any right to complain as to the manner in which repairs are made, whether it is renewed completely or the arch bar is straightened. If the bar is straightened and equipped the same way the car was originally, I see no reason for the car owner to complain, but at the same time, in due fairness to the rule, and also to the fact that it would better the car (and eventually we will not have to renew these bars to strengthen the trucks) it may be well for them to renew the bars and carry out the intent of the rule.

In this respect I might say that our company is figuring on changing out all of the arch bar trucks. We hope to have that done within the next two years. The fact of the matter is we had a proposition a year and a half ago to carry this program out, but on account of conditions in the oil industry we had to eliminate the appropriation and apply it at another point.

Mr. Nelson: I was just about at the point of withdrawing my motion, but in view of the remarks made by Mr. McGrath, I feel quite justified in asking that it be voted upon.

C. C. Hennessey (Big Four): It seems to me that the rule is very plain as written and it really answers every question that has been before the house.

In answer to Mr. Elliott, with regard to renewing the bar that is bent, the rule says "Where necessary to renew an arch bar, or a tie bar," and if you can straighten it, it is not necessary to renew it. (Applause)

As to the charge when you have to put on a top bar on account of the different widths, although the car is derailed, the last paragraph on page 7 authorizes you to bill the increased cost to the car owner for a first application, and if you have to change the top bar in order to make it fit the bottom bar, you can bill the increased cost due to the first application to the car owner.

With reference to drilling the top bar, that is an increased cost and is also authorized in the last paragraph on page 7. I think Mr. Owen stated the question and answer properly.

Mr. Elliott: I want to have everybody get me straight on this. I don't want to renew these arch bars if I can get out of it, and as I said, under the rule I thought we had to. It seems to me that nobody agrees with me, for which I am very thankful.

Mr. Owen: I want to make my stand clear. I don't think it is the intention of the American Railway Association that we renew these arch bars and put on the reinforced size where they are bent and can be repaired. In a great many cases it would retard the movement of a loaded car, very important loads, too. That is what we are here for, gentlemen, to figure out ways and means of expediting the movement of equipment, and when we get up here and make a motion and say that when we slightly bend an arch bar it has to be taken off and a new one made, perhaps we have to send it to a point 100 miles away to a terminal to get that new arch bar made, whereas you could put the old one in a small fire that you have at your small rip tracks and make the necessary repairs in a few minutes.

I can't conceive the idea that this body would go on record as saying that we would be compelled to renew the arch bar that is bent, or other parts of the freight car equipment. It is left up to the repairing line, and it is optional with them whether they renew or repair the parts, providing they make proper repairs.

Mr. Nelson: My only object in offering the motion was that it might be possible to expedite the improvement of this arch bar truck. I thought possibly every car man would be in favor of that, but it is not at all difficult for me to realize that I have the losing side of the argument, so I will withdraw my motion.

Mr. Elliott: I believe a motion might clear this matter, so I move that it is the sense of this assembly here that bent arch bars shall not be considered defective arch bars under this rule in so far as renewals are concerned.

Mr. Gainey: I second the motion.

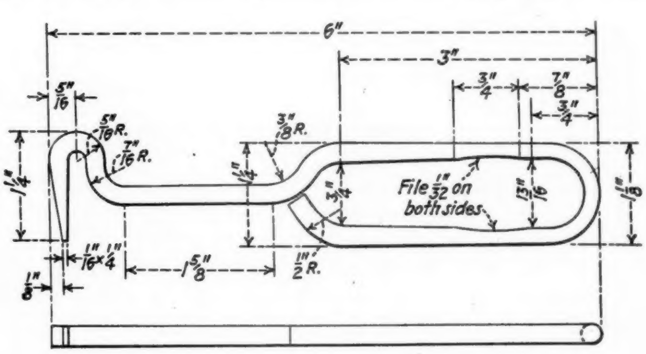
(*The motion was put to a vote and carried.*)

(Mr. Oliver read Rules 30, 31, 32, 36, 60, 66, 74, 81 and 84.)

Gasket tool for steam and air hose

By W. H. Durant

THE combination gasket tool, shown in the drawing, has been used for over two years. The hook-end of the tool is used for removing air-brake and signal-hose coupling gaskets and for cleaning the coupling groove. The hook end of the tool can also be used for lifting steam hose coupler locks and may also be used to remove the Gold type oscillating steam-hose coupler gasket. The



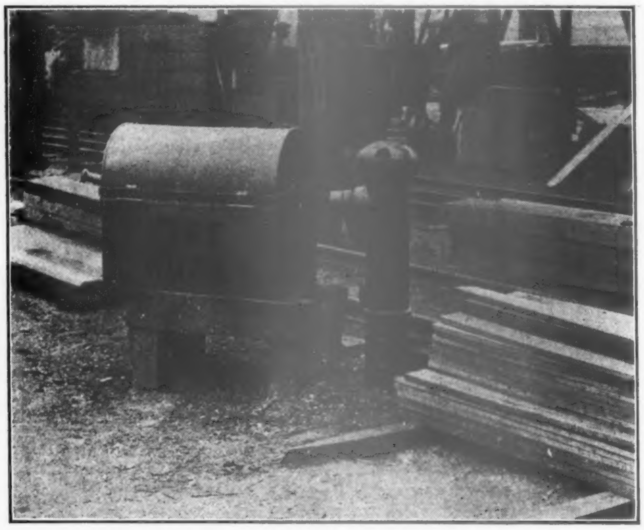
Gasket tool made of ¼-in. annealed steel wire

handle end of this tool is designed to expand air hose coupling gaskets when they do not properly fill the coupling groove, and to remove the vapor type steam-hose coupler gasket by inserting the tapered end over the gasket lock-spring ends. The tool is made of ¼-in. annealed steel wire. A lot of 500 was recently purchased at 7½ cents each.

INSERTED TOOTH CUTTERS.—The Goddard & Goddard Company, Detroit, Mich., describes in a 20-page, illustrated brochure a new and improved line of taper dovetail inserted blade cutters, developed primarily for heavy milling such as is found in the locomotive shop. The new cutter comprises only a blade and body, all wedge pins and holding screws having been eliminated.

Emergency fire hose boxes in the car repair yard

AS a safety measure in case of fire, sheet metal boxes, 18 in. by 24 in. by 30 in., provided with a hinged oval top, have been placed at all fire plugs within the repair yards of the Colorado Southern at Denver, Colo. A hose with a nozzle is always attached to the



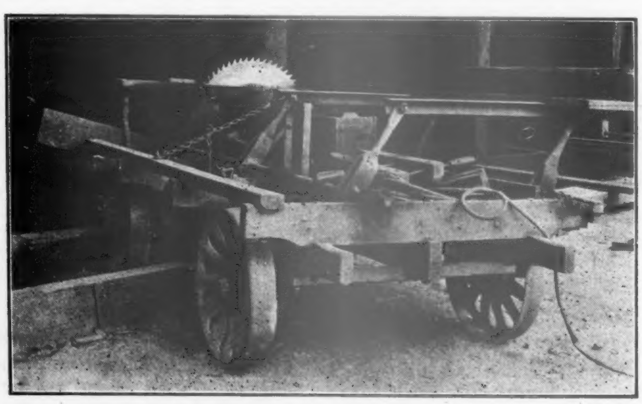
A fire hose and nozzle located in a car repair yard well protected from the elements

hydrants, but is folded up within these metal boxes. A hydrant wrench is left on the top of each hydrant so that the water can be turned on at a moment's notice. Both the fire plugs and boxes are painted a bright yellow so that there is no trouble in locating them in case of emergency. The words, "fire hose," are also painted on the sides of the boxes.

A portable rip saw for the car repair yard

THE portable cut-off saw, shown in the illustration, has proved a time saver in preparing lumber for jobs in widely separated parts of car repair yards.

The saw and motor are mounted at one end of a light push cart. The lumber carriage is made from three 3-ft. lengths of 2-in. angles, supported by six



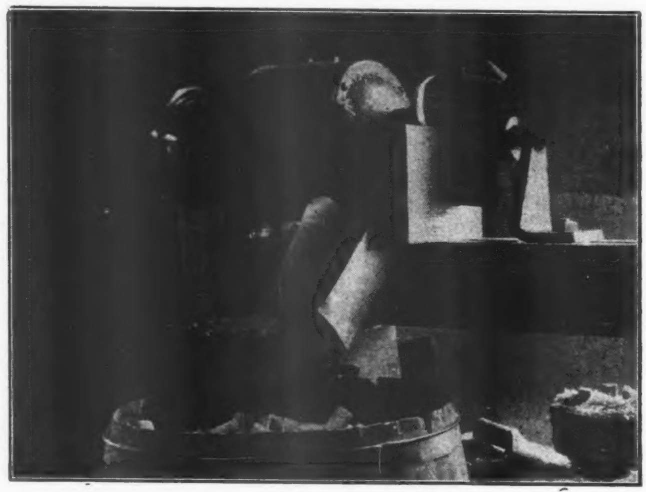
A portable rip saw that can be used to advantage in the car repair yard

12-in. pieces of brake rods, the upper ends of which are bolted to the angles and the lower ends welded to two 1½-in. rods, set parallel to the center line of the car. A board, 10 in. wide, is secured across the top of, and at one side of the carriage, and at right angles to this board is bolted a 1-in. by 4-in. board. This arrangement is used to aline short sections of lumber when being sawed. A chain located at the opposite side of the car from the operator is used to stop the carriage as it is swung back for loading. A section of 2-in. by 4-in. board is fixed flush with the top of the carriage, across the extreme end and close to the saw, which serves as a guard.

An extension cord is provided for connection to the power lines. The truck can be moved from place to place by two workmen.

A handy woodworking machine

A HANDY woodworking machine has been devised in the wood shop of the Colorado & Southern at Denver, Col., for the purpose of eliminating the slow process of turning out flue plugs, surveyors' stakes, and other similar material by hand. A high-speed motor is geared to the spindle of a small lathe. A brass mandrel 8 in. long is screwed on one end of the spindle. A



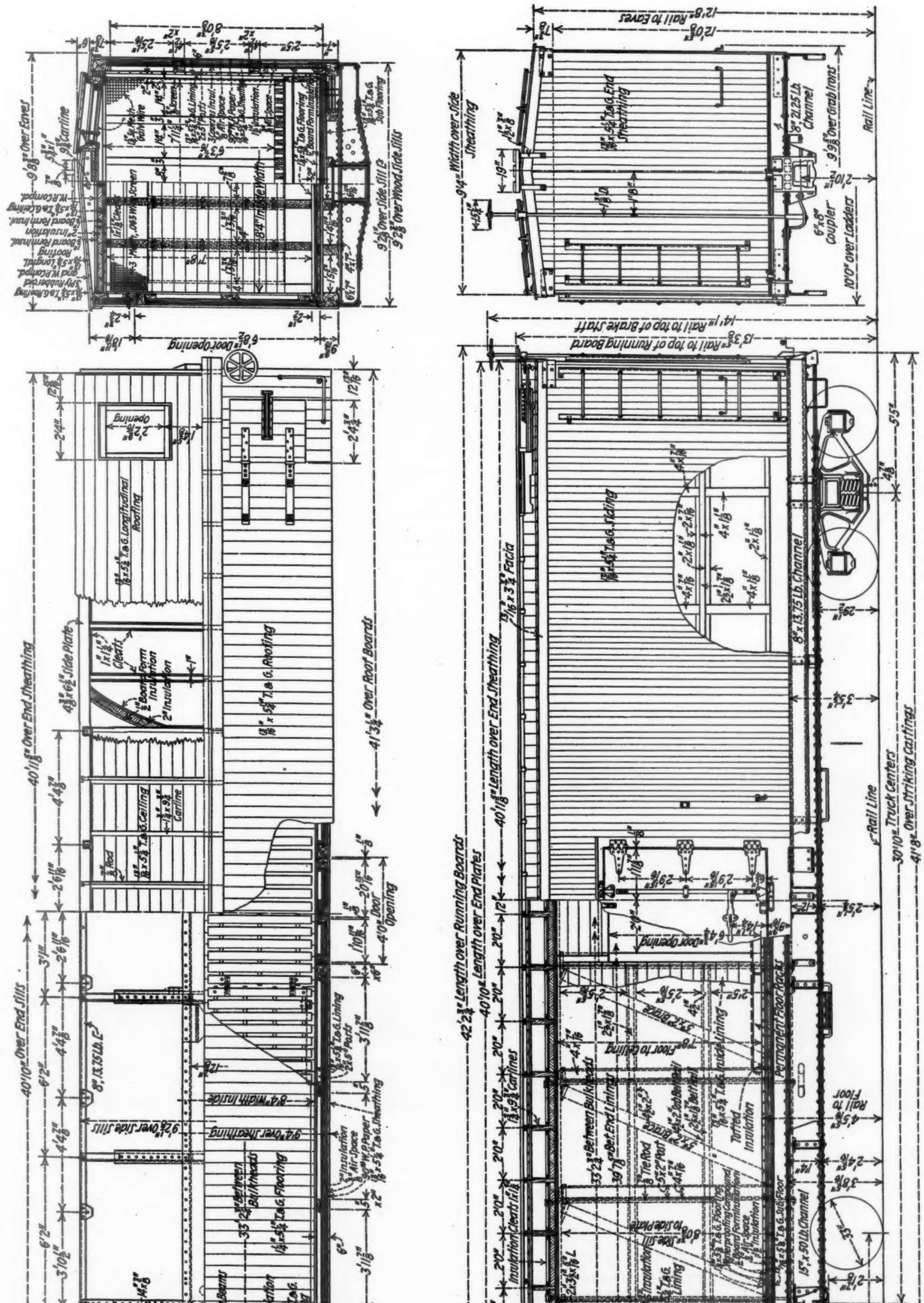
Machine set up to cut flue plugs

small cut-off saw is keyed onto the mandrel about 2 in. from the motor-spindle end. A tapered hole 4 in. deep is bored into the outer end of the mandrel. A wood knife, held by two set screws, extends through a slot that leads in to the tapered hole. The position of the cutting knife closely resembles that of the rotating pencil sharpeners in common use.

In making flue plugs, one end of a stick of wood of proper diameter is fed into the revolving mandrel, the knife of which quickly shapes the plug. After the plug is turned, it is shoved against a small spring gage located on the head of the motor, and the plug cut off by pressing it against the saw blade.

A detachable chute and safety guard of tin, secured to a wooden block, guides the plugs into a barrel placed beside the machine.

The same machine, with a larger size mandrel, is used to turn surveyors stakes. A metal guide, with a semicircular notch in the top and bolted to the lathe frame, aids the workman in guiding the stick straight into the mandrel.



General arrangement of the refrigerator cars built by the Fruit Growers Express Company

Refrigerator cars for the Fruit Growers Express

Waterproof floors, permanent floor racks, depressed pans and basket bunkers feature design

THE efficiency of a refrigerator car is determined, in the main, by its ability to maintain temperatures on the inside of the car well below outside temperatures when refrigeration or ventilation service is used and above the freezing point when insulation or heater service is desired. Refrigeration is effected by the circulation of air; the warm air from the commodity rises to the ceiling, passes through the ice in the ice bunkers, thence passing out through the bottom bunker openings into the body of the car, diffusing through the load, absorbing heat from and reducing the temperature of the commodity. Successful refrigeration or other protective service cannot be obtained unless the commodity loaded in the car is properly packed and stowed so as to provide channels for the circulation of air through and around the lading. Proper loading and packing is of the utmost importance and has been covered by detailed instructions issued by the railroads and given careful attention, both by the railroads and shippers.

The advance in the construction and resultant efficiency of refrigerator cars has been progressive since the benefits of its use were first established and the cars in general use today reflect the developments in the art. They do not vary greatly in dimensions and loading space, which is beneficial both to carriers and shippers. They are generally heavily insulated, to accelerate refrigeration and furnish adequate protection against cold. Basket type bunkers and permanent floor racks are coming into general use.

The practice of body icing has grown up recently and is increasing, particularly in connection with some green vegetables which the shipper desires to keep moist. Under this practice, ice in quantities from one to as much as 12 tons, is placed in the body of the car and all the water produced by the melting of the ice is deposited on the car floor. One ton of ice will release sufficient water to cover the entire floor more than 1½ in. deep. This requires some form of waterproofing and the bunker tank also needs to be depressed so that the water in the body of the car will run into these pans at the ends of the car and thence to the car drains.

The Fruit Growers Express refrigerator cars

The Fruit Growers Express Company is constructing at its Indiana Harbor shop, new refrigerator cars of its standard design, which embody interesting features in the design and construction of refrigerator cars for the transportation of perishable freight, such as bananas, berries, citrus fruits, peaches, other fruits and vegetables of all kinds, packing house products, dressed poultry, eggs, etc. These cars are insulated with high-grade insulation, 3 in. thick in the roof, 2 in. in the side and end walls and 2½ in. in the floor, and are built with depressed floor pans, waterproof floors and floor insulation, and permanent floor racks. The principal dimensions and weights are as follows:

Refrigerator car built by the Fruit Growers Express Company

Length between bulkheads	33 ft. 2¾ in.
Width inside	8 ft. 4 in.
Width over side sills	9 ft. 2⅜ in.
Height from top of floor to ceiling	7 ft. 8 in.
Capacity of trucks	80,000 lb.
Capacity of ice tanks	9,600 lb.

The underframe

The underframe is of the box girder type, consisting of two 15-in. by 50-lb. channels, spaced 12⅞ in. back to back with top and bottom 21-in. by ½-in. cover plates.

The top cover plate runs continuous from end sill to end sill, while the bottom cover plate extends from the front face to the front face of the draft back stop castings. The underframes are braced with deep pressed steel diaphragms as well as corner diagonal braces. The side sills consist of 8-in., 13.75-lb. channels and end sills of 8-in., 21.25-lb. channels.

The floor framing consists of deep wood sills rather than nailing sills in order to facilitate repairs. These sills are bolted to the underframe and are gained at the ends for depressed ice pans. One course of square edge sub-floor is applied over the sills cut to clear the post and brace castings. Over the sub-floor a single thickness of ½-in. board-form insulation is applied, extending full width of the car and in four lengths to reduce the number of joints to a minimum.

Insulation spreaders are then applied, which are spaced over the sills as backing strips for the floor proper so as to provide a rigid floor. One course of 1½-in. thick soft insulation is applied between the stringers, and is held in place by cleating to the subfloor and stringers. The side pieces are of sufficient width to insure a seal when the side wall insulation is applied. One course of ½-in. board-form insulation is then applied over the floor stringers, which provides a ½-in. air space between the 1½-in. thick insulation and the ½-in. board-form insulation.

Waterproofing

A heavy coat of waterproofing compound, mopped over the top course of board-form insulation, seals the joints. While this waterproofing is still hot, a layer of waterproofed duck, 12 in. wide, is applied along the side and end sills of the car. The waterproof duck is arranged so that 6 in. of it may be bent upwards under the lining boards to provide a watertight joint.

The top floor consists of 5¼-in. by 1¼-in. tongue and groove flooring and is nailed to the sills of the car through the floor stringers. All the tongues and grooves are painted with a sealing cement. It will be noted that the insulation and flooring extend over the framing.

The surface of the floor is waterproofed, and it is depressed at the ice bunker, so that any water which may get on it will tend to find its way to one or the other ends of the car when on grades while the car is in motion.

The side and end wall framing consists of wood sills, plates, posts, braces and belt rails, applied in accordance with the usual practice. The posts and braces are set in malleable iron pockets and caps. All side and end wall insulation is applied outside of the framing in mass form.

Wide sheets of board-form insulation, extending from gains in the sills to gains in the plates, are then applied over the entire car framing. Belt rails are applied over the face of the board-form insulation providing three equally spaced sections for insulation The three panels are then insulated with 1½ in. of insulation, securely cleated to the belt rails, posts, sills and the plates forming the panels.

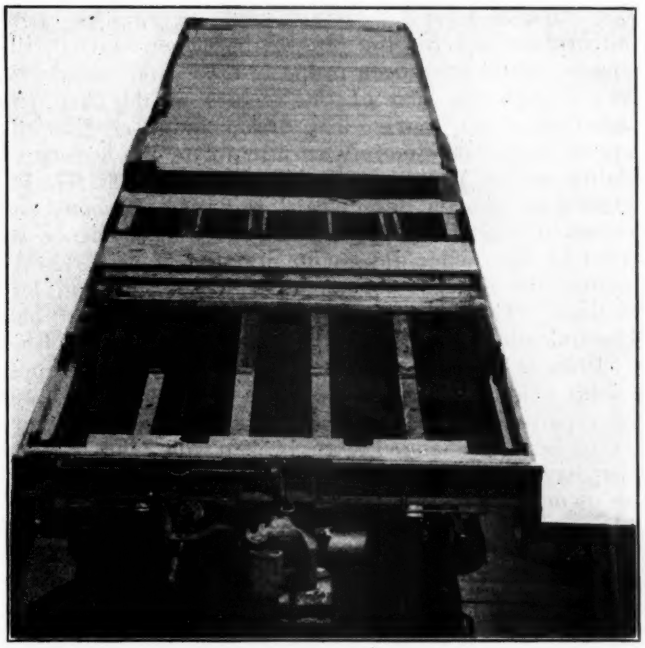
Roof construction

One course of ½-in. board-form insulation, applied under the carlines with joints at every other carline, forms the support for the intermediate roof insulation. When the under course of insulation has been applied, the ceiling is applied; the ceiling is securely nailed to all carlines to eliminate sagging.

One 2-in. thickness of soft insulation is then applied between the carlines of such a width and length as to require forcing in place, and thus assuring tight joints. Over this, one course of ½-in. board-form insulation is applied, which is also forced into place.

A heavy coat of waterproofing compound is applied over the entire roof insulation. As a further precaution to keep the roof insulation dry, the carlines have been provided with four 1¼-in. diameter holes with a like number through the end plates and end sheathing, thus permitting the circulation of air for ventilation purposes between the roof of the car and the roof insulation.

Two courses of board roof are applied with a layer of three-ply composition roofing, lapped along the ridge separating them. Before the composition roofing is applied, the lower course of board roofing is given a heavy coat of waterproofing compound, so as to fill all roof board joints, crevices, etc. An additional course of 12-in. wide heavy composition roofing is applied



The underframe and floor construction

along the entire ridge under the running board saddles in order to seal the roof board joints along the ridge.

Ice bunkers

The ice chambers are of the full basket type of 9,600 lb. ice capacity. The bulkheads are of the insulated type, having 12½-in. bottom and 12-in. top openings and have rolled steel I-beam posts with wood side pieces. Ice pans of depressed type are made of 12-gage galvanized steel with water traps of the inside type.

The doors

The doors are constructed in a similar manner to the side walls of the car with 2 in. of massed insulation over the frame. The Miner type of door locking devices and LaFlare door packing are used. The car proper is provided with a wood threshold block instead of the customary steel plate as a protection against frost. Bolts passing through the door are counter-sunk also as a precaution against frost.

Weather strips made from double thicknesses of canvas applied around a strand of ¼-in. rope, are applied at the bottom inside face of the doors for contact against a metal plate seated in the car floor when the doors are closed.

Decisions of the Arbitration Committee

(The Arbitration Committee of the A. R. A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Joint evidence not always conclusive

On May 29, 1926, the Denver & Rio Grande Western repaired two draft channels on G. B.M.X. Car No. 106, for which a charge of ten hours was made. On July 26, when the car reached the home lines, it was noted that the center sills were bent and broken and joint evidence was secured. The Grain Belt Mills Company, the car owner, maintained that it should have been furnished with a defect card covering the bent and broken sills for the reason that when started, the repairs should have been properly made and completed, even though the cost of the repairs would have run higher than ten hours. The owner indicated that the repairs made were merely an attempt to evade responsibility under A.R.A. Rule 44. The D. & R. G. W. refused to issue a defect card to cover the bent and broken sills on the grounds that the joint evidence secured by the owner did not involve the D. & R. G. W. because the defects developed after the car had left its lines. The investigation showed that the car had been unloaded at the home plant of the owner on June 17, 1926, at which time, if defects had been in evidence, a joint evidence card would have been procured, and the repairing line further contended that, as cars are not to be interchanged with broken sills, the damage must have been sustained after the car left the plant of the owner.

In rendering its decision, the Arbitration Committee stated that "There is no evidence that repairs were wrong when the owner accepted the car on first arrival home without complaint. The Rules do not contemplate the use of joint evidence in cases of such character."—*Case No. 1565—Grain Belt Mills Company vs. Denver* N *Rio Grande Western.*

Report of disinterested inspector convincing evidence that defects existed prior to derailment

On May 16, 1927, while a P.H.R.X. tank car No. 1029 was en route from Wichita Falls, Texas, in a Ft. Worth & Denver City train, it left the rails and fell down a 40-ft. embankment and finally stopped some 60 ft. from the track. On May 22, the car was set on the tracks of the Panhandle Refining Company with defect cards attached, at which time an inspector for the owner rendered a report stating that the defect cards attached failed to cover two 15-in. by 9-ft. 3-in., 50-lb. body bolster channels broken and bent up at all four corners and one bottom center plate broken. The handling line was asked for additional carding to cover these three items, which were refused on the grounds that the crack in the body bolster channels and the break in the center plate were filled with oil and rust, which proved them to be of long standing. In order to be fair in the matter, the handling line had an inspector of the Wichita Falls & Southern make an inspection, after which he agreed that the defects in the bolster and center plate were old. The owner maintained that Rule 32 covers all damage to cars if caused by derailment and therefore the defects in question should be covered by defect cards.

The Arbitration Committee, in rendering its decision, stated that "If the defects in question existed prior to derailment, the handling line would not be responsible for that portion of the repairs. Inspection by a disinterested inspector of the Wichita Falls & Southern is the best evidence upon which to base a decision that these defects were old and existed prior to the derailment. Therefore, the owner is responsible."—*Case No. 1566—Panhandle Refining Company vs. Ft. Worth & Denver City.*

Repairing line held responsible for wrong repairs made to draft gear

The Indiana Harbor Belt issued a repair bill to the Chicago & North Western in which were contained charges covering the application of wrought-iron follower plates, 1½ in. by 6 in. by 10 in. and 12 in., to take up the slack in Waugh draft gears, due to broken spring-steel draft gear friction plates. The owner contended that the application of wrought-iron follower plates 1½ in. thick, in lieu of the special spring steel Waugh draft gear friction plates ½ in. thick, was wrong repairs for which no charges should have been made. The handling line was of the opinion that replacing wrought-iron follower plates for the special tempered spring-steel plates, only decreased the functioning of the draft gear 17 per cent, which, in its opinion, would not impair the functioning of the car and, therefore, should not be considered wrong repairs.

In rendering its decision, the Arbitration Committee stated that "The Indiana Harbor Belt is responsible for wrong repairs and should have, at the time the wrong repairs were made, attached its defect card to the car for the labor only of standardizing the repairs, as per Rule 88.—*Case No. 1567—Chicago & North Western vs. Indiana Harbor Belt.*

Not necessary to remove steam hose when renewing a broken lock

On March 9, 1926, the Southern Pacific applied a new steam hose to American Railway Express car No. 736 on account of a broken lock. The owner took exception to a bill rendered for a new hose, claiming that it should have been confined to the steam hose lock only, for the reason that this is a separate and repairable item, the same as a gasket, and can be renewed on the hose without being removed from the car. The Southern Pacific repair card did not show anything defective or wrong with the steam hose itself. The Southern Pacific contended that the lock is a component part of the coupler and is not analogous to a gasket, which is a detached part and for the renewal of which a specific labor charge is provided under Rule 21. The S. P. also contended that it is unreasonable to require inspectors to carry a supply of these locks for use when needed and, therefore, in order to expediate the movement of the train, it was necessary to remove the entire hose and substitute a good one.

In rendering its decision, the Arbitration Committee stated that "The steam heat hose coupler lock in question is so designed that it can be readily renewed without removing the hose from the car. The charge should be confined to renewal of the defective lock."—*Case No. 1572—American Railway Express vs. Southern Pacific.*

Machine tools—their use and application*

Extended use of grinding and milling machines offers increasing opportunity to improve machine processes

By L. A. North
Shop superintendent, Illinois Central

THIS paper will deal almost exclusively with the attitude of the railway repair shops, the problems which are now confronting them and what can be anticipated for the future, basing the requirements on past experience.

One of the first and most essential points to be considered is that of securing the greatest production with the minimum of labor cost, taking into consideration the cost and changes necessary to bring about this condition. Careful and close study is necessary if the cost of the proposed changes and expense are to be justified and returns made which will show the adequate increase in production that was anticipated. Large sums of money are spent annually in making changes in machine tools and shop surroundings to keep up with the increased areas and weights of parts to be machined and maintained.

The number of parts per locomotive as well as weights are constantly increasing and with this idea in view it is all the more necessary that new ways, new methods, and higher production be established to keep the cost where it should be.

Many shop kinks are developed by supervisors and shopmen which assist materially in overcoming additional machining, not only on machine work, but on floor and bench work as well. This should be encouraged more in the future than it has been in the past. The machinery manufacturers have been more than liberal with their help and suggestions, working in close cooperation with the shop management in helping to solve many of their problems by sending representatives to spend time in the shop and make a complete study of their needs and requirements.

Other conditions will also enter into the plans for increased production, an important one being the human factor. If the workman can be induced to realize the necessity for the proposed changes and become interested in future betterments, his efforts will enter largely into the further advancement of this undertaking. Numerous ways have been tried to obtain this cooperation. From observation the plant that rewards the employees or shop management for their best efforts has thus far proved the most successful. Pleasant and comfortable surroundings, cleanliness and a constant regard for safety, help to obtain what we are constantly striving for. Encouragement extended to employees by their supervising officers also greatly assists in this respect.

In order to express the attitude of the railways toward the introduction of new tools and new methods, there are five subjects which I wish to dwell on briefly: (1) Grinding, (2) milling, (3) drilling, (4) turning from bar stock, and (5) lapping and honing.

Grinding

The field for external and internal grinding has been developed to some extent in the railway shops, and is being still further advanced by new machines designed to meet the requirements of new operations and practices. Many parts formerly turned, planed, or slotted are now finished in a far shorter time by grinding. Metal is saved, which in itself adds to the life of part being machined. As an illustration, piston rods are renewed on account of size, age, or defects. If less metal can be removed and the rod trued up, longer life to the rod has been brought about at far less cost than by the former method of turning, due largely to the time reduction by the latest machine designed for this purpose. A piston rod having a length overall of 77 in. with a large diameter of 4⅛ in. on the cylinder end, the extension-end

* The abstract of a paper presented at the Second National Meeting of the A. S. M. E. Machine Shop Practice Division, Cincinnati, Ohio, September 24 to 27, 1928.

diameter being 3 in., was finished by grinding in 58 min. with a diameter reduction of 0.030-0.060 on the steam end and similar diameter reduction on the extension end. This same operation consumed 2 hr. 45 min. on a modern heavy-duty lathe with a diameter reduction on the cylinder end of 5/64 in. and on the extension end of $\frac{1}{16}$ in. The grinding operation was more satisfactory because a shorter time was required, less metal was removed, and a better finish was obtained. One of the recent machine tools which has been installed in a number of railroad shops is for the purpose of internal grinding. On a No. 5 New York air pump, all four cylinders have been ground in 4½ to 5 hr., perfect alinement thus being assured which was not always the case when the pump was dismantled and bored on the boring mill, then assembled again in an average time of 10 hrs. This developed that less metal was removed and a better finish obtained. Air reverse cylinders, air fire-door opener cylinders, grate-shaker cylinders, stoker engines, and numerous other pieces of equipment can be taken care of in this manner. The solid-end main rod or adaptor can be trued on the inside in this way at far less cost, and a smoother running surface can also be produced than by previous methods. Solid side-rod holes, where elongated in service, can readily and cheaply be brought back to a perfect diameter which insures the bushing when applied having the correct fit and bearing.

Crank pins and driving axles can also be included within this same category. Care must be given in the selection of wheels for this purpose on account of shape and size of fillet used on both axles and pins. Side pressure will, unless properly controlled, cause grinding wheels to break. This operation would apply to journaled surfaces only, as time would be lost in attempting to grind a pressure fit on either pin or axle.

Some thought has been given to tire grinding, also some experimental work has been done in reducing flat spots on car wheels. Unless a very small amount of metal were to be removed, tire grinding would not interest a railroad as grinding on the flange would slow up this operation over machine turning and destroy any saving that would otherwise be effected. The method of grinding out flat spots on car wheels does not produce a perfect wheel. Some objection has been made on this account, although this practice is in effect on some railroads.

The grinding of locomotive cylinders and piston-valve bushings would furnish a smoother surface than the present method. The removal of all abrasive matter after the work has been completed would be necessary, of course, and a very stiff arbor would be required to eliminate springing in order to insure a straight bore. Present-day material has reduced the amount of metal to be removed to some extent; this refers to a closer grained, tougher, and harder grey iron. The alinement necessary for the valve chamber bushings in order to secure friction reduction and smoother operation of the valve gear would make it necessary to do this class of work with the bushings in place. Past experience has been our teacher in this as well as many other similar cases. One feature of the wear on these bushings is the long and short travel of the valve which has brought about some peculiar conditions, making it good practice to true up the bushings each time the engine is in the shop for classified repairs, calipering being deceptive in locating bushings out of alinement. Increased grinding will be used for future operations as machines are developed for such purposes, resulting in shorter time required over boring methods as well as producing smoother surfaces.

Milling machines

Milling machines are taking a prominent part in railroad shop practices. Further development can be made and production can be increased and cheapened by a closer study of machine-work needs, keeping in mind the introduction of harder and tougher metals used in locomotive construction. Chrome-vanadium steel, as an illustration, is used in side and main rods as well as in motion work. This feature must not be lost sight of if expectations are to be realized and the objective gained. Other machine work can also be done if tools are designed purposely for certain tasks where sufficient parts of one kind would warrant the establishment of production. This would not be confined necessarily to any one set task but would be made flexible enough to carry on enough tasks to make such machines profitable to the railroads.

Drilling

Drilling operations are necessary in any railroad shop. Various machines are used for various purposes, namely, the full radial, the semi-radial, the multi-spindle, and the vertical. Very little use is found for the full radial. Such angle drilling as is necessary can be done on either the semi-radial drill or on vertical drill presses with tilting tables. Formerly drill presses were used for cutting out solids now done with the oxygraph. This required a heavy machine capable of performing heavy-duty work, cutters and boring bars forming part of the equipment used for this purpose. Multiple work also is done on these machines. One operation is that of drilling wrapper or firebox sheets five and six at one time. This requires a heavy stiff arm and well designed post with other parts in proportion. The time gained over punching sheets is very marked. There is also no evidence of fracture in this important part of the locomotive when it is drilled as is the case when holes are punched. With the multiple-spindle machine one operator can greatly increase production on work such as spring rigging, small bushings, and other work of a like nature. Machines of this kind should be fitted with a simple and suitable chuck for rapidly clamping and securing parts thus to be machined.

Turning from bar stock

In turning from bar stock from which cap screws, hexhead machine bolts, studs, and other parts are made, close study is required in order to avoid wasting money by the waste of material that otherwise would be saved in labor if this operation were used. The time reduction by means of a special chucking feature has been marked on this one class of work. We do not have at this time figures to show the exact saving, but I believe it will amount to at least 10 per cent. These special chucking features also enable the operator to turn satisfactorily bolts that have been made in a bolt-heading machine. A taper attachment brought out recently permits the turning of taper-fit bolts in this manner in a much shorter time than by turning on lathe centers. This gain will not apply to all cases because it becomes necessary to reduce the bearing fit on bolts having a long fit, particularly rod bolts. A test was made of nine bolts of the same length and diameter. Three bolts were turned on lathe centers complete in 2 hr. 59 min.; three bolts were chucked by the bolt head and turned in a turret lathe complete in 4 hr. 21 min., and three bolts were turned from solid bar stock complete in 6 hr. 32 min. In the last test 43 lb. of material was wasted. The machines used in this test should not be confused with multiple-head machines as these machines have proved very satis-

factory when used on production work, the first objection having been corrected when the machines were first introduced using the full-length blade. At that time an imperfect bolt was formed because the blade followed seams in the iron; the shorter blade corrected this trouble.

Special chucking features have also been added to other machine tools. Just a few years ago 30 min. was considered good time for boring a locomotive tire 49½ in. inside diameter. This operation is now done on a special heavy-duty boring mill in 7 min. Special chucking features have assisted in reducing this time. Thirty-odd years ago from 45 to 50 hr. was required to turn a pair of 56 in. tires. The present time is about 50 min. to one hour per pair. Special chucking features and forming tools used in conjunction with high-speed tool and specially designed heavy-duty machines have brought about this reduction in time and enabled the locomotive shops to keep pace with the increased areas and parts to be machined. These special features have reduced the fatigue of the operator also and added to his personal comfort, bringing good returns for money invested. The attitude of the railroad shops cannot help but be favorable to these improvements.

Lapping and honing

The fifth subject, lapping and honing, does not interest the railroad to any extent except airbrake parts. Some improvements have been made over the hand methods, particularly in repairing triple valves and other small parts which can be handled on a production basis.

A catch-all tool rack

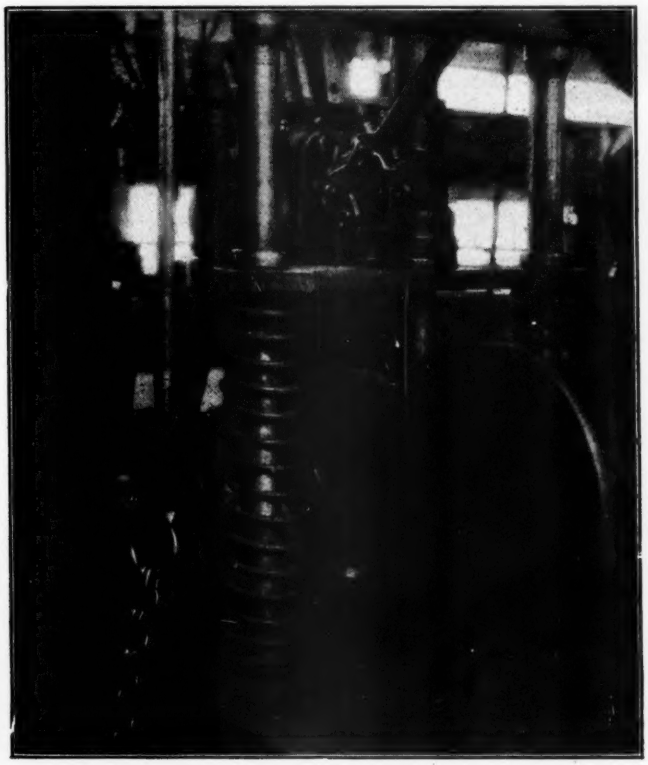
THE tool rack shown in the illustration will be found useful in the machine shop where there are many different tools and appliances to be stowed away that frequently are left to lie about under foot. The advantage of this rack is that it enables a large number of assorted tools to be kept in a small space, accessible from four sides.

A substantial, convenient catch-all tool rack

A strong steel frame, 3 ft. by 4 ft. square and 4 ft. high, is built up by welding and bolting. Two steel tables are fastened in the frame. A table 3-ft. by 18-in. is located at the top. The bottom table, or shelf, is used to hold bars and larger tools. The other two shelves contain a row of strong hooks, spaced 6 in. apart, around the outer edge. As may be seen from the illustration, these hooks are highly useful. Sloping racks 7 in. high with an angle at the bottom and iron pegs at the top, are located on two sides of the top table. These racks are used to hold punches, drills and other tools of a similar character.

Removing bushings from air compressor heads

REMOVING the end bushings from air compressor heads by hand methods is slow work. The cost of purchasing a power operated machine for the work is not always justified for a small shop. A quick and efficient method of doing this job has been worked out at the Denver shop of the Denver & Rio Grande Western. A 2-in round steel post is set in each side of a heavy steel block, 3 ft. square and 6 in. thick. The two posts are 3 ft. high and have a heavy bar of steel bolted across the top. Around the lower end of each post is a heavy coil spring, each of which helps to support a 1½-in. steel plate. A small hydraulic jack rests on this plate. The cylinder head is swung in position with an air hoist, after which one end of a punch is placed directly under the jack and the other end is placed on the bushing. Raising the jack ram against the upper steel block forces the steel plate down on the springs, which in turn causes the punch to push out the bushing. When the jack pressure is released, the jack remains in place ready for use again.



An effective device for removing bushings from air compressor heads

CAST IRON AND ITS MANUFACTURE.—A series of technical articles on cast iron and its manufacture, prepared by Dr. Edward E. Marbaker, is being published by the Whiting Corporation, Harvey, Ill. The results of Dr. Marbaker's studies and investigations cover various phases of the foundry industry.

The general-purpose tool*

How general should it be? Some degree of classification of work and specialization is necessary even with all-around machines

TOM James needed shrubbery in his front yard. Not that Tom James had ever recognized the need, but his wife had discovered that the neighbors had shrubbery, while the James' had none. Therefore, Tom James must buy shrubbery.

The idea of taking on a contract as landscape gardener did not particularly appeal to Tom until he remembered that his friend Bill Babbitt of the Evergreen Nursery Farms up in Carbon Valley district, would be able to supply his needs. Incidentally, in case he chose to call on Bill, Tom would find it entirely convenient to drive around by the way of the Carbon Valley Railroad Shops at Rockside and persuade friend Highball Scott, master mechanic, to lay aside his cares for the day and aid him in selecting suitable shrubbery. All the while

Highball joins Tom James for a day with Bill Babbitt

the prospect of a visit with the ex-supplyman, Bill Babbitt, as well as the assurance of a good country dinner, by no means deterred the Commercial Engineering Company's representative from going in person to make his selection of shrubbery.

Highball was not hard to persuade. Recollections of the last dinner at Evergreen Farms, presided over by the gracious Mrs. Babbitt, impelled Highball to yield gracefully to Tom's invitation to take the trip. Aloud, Highball explained to Tom that he was really too busy to go for the day, but at the same time, having had quite some experience as a landscape gardener, he felt that he owed it to Tom for friendship's sake to accompany him and aid him in his selections. The truth was that Highball's knowledge of landscape gardening was very limited, but so long as it afforded Highball a legitimate excuse for absence for the day, after repeating his statements once or twice, Highball finally believed himself, and left his desk with the firm conviction that it was the necessity for aid on the part of Tom James and not the prospects of a pleasant visit at Evergreen Farms which was drawing him away from his daily toil.

Things were moving along smoothly at Evergreen Farms. Bill had purchased some new livestock, of which he was very proud. Of course, Highball and Tom were interested and must needs go with Bill to the barn and meet the new "Sultan of the Dairy Herd." Returning to the house Tom James commented on a pen of hens which were added to the poultry yard since the occasion of their last visit. The hens were rather small, but very nicely marked, and would be classed by a poultry judge as high grade lot of chickens. Highball studied the hens intently for a moment and finally said:

Bill's specialized egg-layers

"Bill, what is your idea in keeping that lot of narrow gage fowls on your place?"

"What do you mean?" asked Bill.

"I mean," said Highball, "that if they are full grown hens they were pulled too soon. My opinion would be that it would take several of those birds to make a respectable meal for a fair sized family."

"Oh, I see," said Bill. "You are right enough. Those hens are egg producers. We do not raise them for killing purposes."

"Well, even at that," said Highball, "I would imagine you would have to put side curtains on those hens to make them cover more than six eggs when they set."

"We don't let them set," said Bill. "Understand, those hens are specialists. Egg producers pure and simple. They lay the eggs. When we raise chickens, the chicks are hatched in an incubator and raised by the aid of a brooder. The hen is relieved of both these duties, which allows her to attend strictly to her one job of laying eggs."

"So," said Highball, "then you just wish a wooden stepmother and a galvanized iron nurse on these poor chicks as you start them on their way in the cruel world."

"Right," replied Bill.

"Do you keep this chicken raising equipment working all the time?"

"No, just in the Spring."

"Don't make much out of the investment during the idle periods then?"

"No, but it pays enough when in use to double the loss of the idle periods."

A dinner beyond Highball's fondest dreams was next in order. Following this happy occurrence, Bill and his guests sat down for a chat. The World Series and the political situation were in turn brought before the meeting and promptly acted upon. The inevitable—Shop Talk—followed.

Highball tries to select a lathe

"You know, fellows," said Highball, "I got myself into a nice corner a few days ago. The wife has a cousin who is holding down a job in a railroad shop in this vicinity. Seems this cousin's predecessor, whom cousin-in-law only recently succeeded, had persuaded the boss that the shop needed a new lathe. During the interval between the request for the machine and the final decision that it should be purchased, the new man comes on the job. His boss comes in one day—imparts the glad tidings that the money is available to purchase

* The fifth of a series of stories by a railroad man who was once a peddler.

that new 30-in. lathe. 'Here is a bunch of proposals,' says he. 'I am going to be away for the next couple of weeks. You look these over and select the one we should buy. Also, keep in mind that if you choose any but the least expensive machine, you should show a good reason for the additional expenditure.'

"Cousin is quite an observing sort of a cuss, and while I was visiting him, casually inquired if I had ever had much experience with machine tools. I told him yes, I had had lots of experience. I really believed that I had. I ran a drill press, shaper, lathe, and planer years ago, although as I now look back over the facts, it occurs to me that most of the work I did on those machine tools was in my younger days, and that I was never trusted with any complicated or accurate machining operations. Also, I learned with a heavy jolt that machine tools had changed plenty since the time of the Chicago World's Fair when I was serving my time. My host invited me down to his office that afternoon and after getting things working smoothly, confided to me that he has had plenty of experience in shop work in general, but feels a little timid about saying the final word in the selection of a machine tool. In other words, depending upon my years of successful machinery experience, he has decided that I am to be the consulting expert who quickly says: 'Select this machine, pass up that one,' and in each case gives good double-riveted, copper-bottomed reasons for the why of my statements.

"I looked over the illustrations of these new tools and read the specifications, after which I promptly regretted that I had committed myself in regard to my knowledge of shop equipment. I discovered that watching the performance of a lot of shop equipment, supervised by a capable foreman, is entirely different from digging down into the details of machine design and construction, and selecting the best tools for the intended purpose.

"I also discover that this man, who feels that he is lacking in knowledge of shop equipment really knows more about the subject than I do. However, I hated to quit cold, so, by asking many general questions and not committing myself too definitely, I feel that I can stall through. Cousin-in-law explains that they do not want anything special in the way of a lathe. Just another lathe added to what they already have, will make one lathe more. I take my cue from this and ask him what particular line of work he expects to handle on this machine. Well, he tells me he should have a machine long enough to handle a driving axle, and that his driving axles run a little over 6 ft. in length. It would come in handy for swinging piston valves assembled. She should be big enough to chuck and picket follower plates over the edges. The largest cylinder they have on the road is 26 in. It would be a handy lathe to handle piston rods, too."

He tries to compare capacities

"He has made a start by drawing up a table showing the capacities of the different machines, together with prices, but there is a lot of detail that he does not get on the table because, in many respects, no two of the machines are alike. For this reason it is hard to tabulate the information. First he puts down the swings. Four of them ran something like these figures:

31½ in. 33½ in. 30¼ in. 31 in.

"Then he has a column of swing over the carriage like this:

23½ in. Not given 21¼ in. 20¾ in.

"Thus we discover that the lathe with the biggest swing, which is 33½ in., is an unknown quantity so far as swing over the carriage bridge is concerned.

"We next compare the distance between centers:

7 ft. 9 in. 7 ft. 8 ft. 1 in. 6 ft. 11 in.

"The weights vary too, somewhat. I do not remember the exact figures, but I know that the weight of the heaviest was practically double the weight of the lightest.

"When it comes to prices, they are just as widely scattered as the rest of our figures. Well, he says to me, 'First I tried dividing the price of the machine by the number of pounds in order to get the price by the pound. Here I find another discrepancy. The heaviest machine on a pound basis is cheaper than one of the lighter machines. On the other hand, while the heavy machine is undoubtedly a good machine, it simply costs too much money, and I will never be able to explain all this amount in the face of the fact that cheaper machines are available.'

"Next we consider the rated capacity of the machines. He starts out to buy a 30-in. lathe and finds that he can get one which will swing 33½ in. Now the question arises if a 30-in. lathe will swing 33½ in., why shouldn't he be able to buy a 27-in. nominal size machine which will swing 30 in.? If such is the case, he feels that he should get another proposal on a 27-in. machine. Reasoning out further along this line, however, he finds that the 33½-in. machine is the one that takes 7 ft. between centers. On length he can get a machine that can take 13 in. more between centers than this one, while there is only one machine shorter, and that difference is the slight matter of one inch.

Bill shows Highball and Tom his egg-laying specialists

"We are rapidly getting nowhere in our deliberations, so we tack around to another angle. He has some good books and up-to-date magazines containing valuable matter on the subject. We, therefore, refer to these and find that it is possible roughly to divide the various features of the machine and grade them by points in a manner somewhat similar to the way a stock judge would rate your prize bull.

"Apparently we are arriving somewhere on this so we start to compare the machines in detail. Another snag. One machine has the motor mounted directly above the enclosed headstock, which appears to be a direct gear drive. This builder leads us to think that by this arrangement everything about the lathe is accessible and the motor is up out of the way. That listens good.

We have no belt tightener or other complications to maintain. We are pretty well sold on the motor-on-top idea."

A confusing array of drives

"Well, we pass along our list and later discover that a motor in a cabinet leg, with a leather belt pulling down on the headstock, is, in the mind of the author of the pamphlet, the very latest word in construction. His argument is that the belt helps hold the headstock down to the lathe bed. However, if such is the case, I have a suspicion that the builders may be leaving out some of the cap screws that were formerly used on belt drive lathes when the belt pull was upward, away from the bed. Regardless of that, however, I have never seen a belt-driven machine pick up its own headstock and send

Highball tries to select a lathe

it up to the countershaft by means of the cone belt.

"Another builder has his motor overhead and drives with a silent chain. We can readily see in this case that there is no pull beyond the actual load of the drive imposed in this manner.

"Considering, then, the drives, we have direct gear, rope, silent chain, and leather belt. I admit I am not enough of an expert to say which is the best.

"Then take the oiling system. Some describe the oiling system; some do not. One type has a pump which I imagine is something like a force lubrication in an automobile engine. Another type pumps the oil into a suitable receptacle from which it is cascaded down over all the gears. In this manner the gears and shafts of the headstock run in oil at all times. Another place where I am rather reluctant to make a decision."

Gears vs. aprons

"Then the gears. We have heat-treated gears, gears of specified alloys, and in some cases the material is not mentioned. Going farther into the gear question, we have our choice between the plain, every-day or garden variety of gears as you might say, and helical gears, and also gears of a special form which we believe are much stronger than the ordinary gear. This is another detail to cause us to waver in making our choice.

"One builder shows the inner workings of the lathe apron, which, we learn, is the double wall type, while others do not mention whether the apron is the double-wall type, or whether it is a hemstitched and hand embroidered apron, or whether it is just a plain every-day apron. In some cases the constant speed motor, even though it be direct current, seems to be the choice type, with mechanical changes to govern the speeds. In other cases we have a variable-speed motor, which gives us quite a speed range without the necessity of a gear shift. That idea rather appeals to me as my recollection of lathe work is that if for any purpose you stop a lathe when it is taking a fairly heavy cut, unless you disengage the feed and allow the cutting edge of the tool to free itself before stopping the machine, you may find the edge of the tool broken when you start again. However, all that is a minor matter of detail.

"One builder gives you a cabinet-leg machine; another the plain leg. One stresses a certain new type of bearing which has of late years entered into automotive construction. Another calls attention to the fact that he uses a special alloy in the bearings, while a third makes no mention of the particular advantages of the kind of bearing which he uses. One gives the diameter and length of the front and rear bearings of the spindle.

"I find that one has a spindle which is considerably larger than the other, but decide that the smaller spindle must work satisfactorily, otherwise the builder could not continue to market his product.

"One builder calls attention to the superior construction of the ways of his lathe, while another makes no mention of the quality of the lathe ways, but calls attention to the fact that the feed knobs on his apron are quicker in action and more positive in engaging than any machine on the market.

"I note that one builder, whose reputation is second to none, places the back gears directly beneath the lathe spindle. In other cases they seem to be in the rear. Anywhere from a point horizontal with the spindle at the front down around a 90 degree arc to the bottom location I have just described, always seemed to me to be the logical place to install a back gear. It has always appeared to me, in watching the operation, that the back gear lifts the spindle from the rear, while the cutting resistance lifts it from the front. This leads me to believe that between the two lies the reason for a good many chattering lathe spindles. However, as I am a locomotive man and not a tool builder, I will not go farther on that point.

"Boiling it all down, I gracefully duck from the job by telling cousin-in-law that it is past the time that I promised to be back at the house to take my wife home. I, therefore, wish my relation many happy years and promptly get out of his sight before he discovers any more matters to wish on me.

"Now, in your opinion, Bill, what could be done to improve this condition?"

Why insist that a machine do everything?

"Before I commit myself," replied Babbitt, "I crave additional information. First, how would you purchase a lathe for the purposes you have described? I am thoroughly familiar with the fact that there is no machine tool so useful or adaptable for so many purposes as is an engine lathe. However, when work is so diversified as are your repair-shop operations, would it not be advisable to make an effort to classify your machines. Your work may be general, and yet at the same time parts of it will admit a profitable specialization. I should think it would be a good practice for your friend to analyze his work.

"If he has a reasonably large quantity of chucking jobs, for example, but does not have a sufficient amount to justify a special chucking machine, why not select a machine with a bed of a definite maximum length and equip this machine with special attachments that, when applied, will convert the tool into what you might call

a semi-special machine. If, for example, your friend could so arrange his work as to keep one machine fairly busy turning driving axles and crank pins, he would need a very simple machine for this work. The two essentials would be power and rigidity. The machine would need a screw-cutting feature for threading crank pin ends, but would not of necessity require a quick-change-gear assembly to cut from 20 to 40 different threads. Undoubtedly a machine of that type, if asked for, could be built for far less money than the lathes you have described.

"When you pass through the wheel department of a car shop, do you see car axles being turned on an engine lathe, which is equipped with a taper attachment, quick change gears, hollow spindle, and all those other refinements. Of course not. You see a simple, rugged, convenient machine. A special tool for that single purpose. Not driving, mind you, one tool, but two, working the axle from both ends, at the same time.

"I believe when you compare that axle lathe with the average engine lathe in the matter of production, you would find that it would be profitable to keep an axle lathe in the shop even though it only worked 25 per cent of the time. This thought may in a measure dispell your dislike, or rather your reluctance, towards the use of special machines. In a plant where there are a goodly number of locomotive tires to bore, in goes a special tire mill. It will do enough more work than a standard machine to pay for its idle periods."

"I am inclined to go along with Bill, in his idea," answered Tom. "I saw a good example when we looked at his hens out in the poultry yard. When he can get a hen that is a specialist in laying large quantities of eggs, he cannot afford to keep a general purpose hen which lays eggs for a while, then puts in a portion of her valuable time hatching the chicks, after which she switches to an entirely different class of work and goes out mothering her flock.

"When he wishes to grow the makings of a fried chicken dinner he does not go in for the egg producers, but goes over to the variety which turn their food into pounds of chicken on the hoof."

"All perfectly reasonable to me" answered Highball, "but it hardly answers my question as to how I would best go about selecting a lathe for railroad shop work."

"Rather hard to answer," said Tom Jones. "Probably the most intelligent way to go about the matter is as your friend tried by deciding the rating of the machine by a given number of points for each individual feature. I admit, however, that this method has its faults, as there are some features on various machines which are dissimilar. Continuing farther in this line, it would be unreasonable to expect that, when machine-tool builders do not agree in their methods and practices, a man engaged in the maintenance of railway equipment would be in a position to judge which principle, in the long run, would be the most satisfactory."

Standardization of details

"Some 60 years ago," said Bill, "you railroad people were compelled to adopt certain standards in the construction of railway cars because it was forseen that railway cars sooner or later would be repaired at whatever point in the country repairs became necessary, regardless of whether the car was on the lines of the owners or those of some other company. Stocks of repair parts, at least the ones most frequently subject to renewal, unless they were similar, or you might say interchangeable for cars of certain sizes, would be prohibitive to carry. The thought of sending to the home road for some detail piece while a loaded car reposed on the siding, was also out of the question. Therefore, you people wisely adopted certain standards and have since adhered to them.

"While the exact composition or make up of those detail parts may vary, the outer dimensions or those features which make for interchangeability, are rigidly insisted upon. You have carried this standardization practice out to a point where you have certain specifications in the matter of lumber. You now have your standards even down to such details as to the dimensions for threads of locomotive nuts.

"So long as machine tool builders have an annual output of ten or fifteen thousand lathes of various types, it would not seem extremely difficult to get together with them and develop some sort of a general specifications for tools suitable for use in the railroad shop. You do not need for locomotive work a tool to go to the refinement of the last split ten thousandths of an inch in accuracy. After you reach a certain degree of accuracy, farther refinement is certainly an unnecessary embellishment. On the other hand you do not want a cheap, lightly constructed tool such as would be suitable for a garage or small repair shop, or for the use of an amateur. Suppose you men instead of trying to buy a lathe with a 14-ft. bed, would say that you required a lathe to take 4 ft., 6 ft., or 8 ft. between centers. Suppose you would be liberal and say you wanted a lathe in a 20-in., 24-in., 30-in., or 36-in. swing. The smaller intermediate swings simply mean additional overhead builders' costs in the matter of patterns, jigs, and drawings.

Specifying the job instead of the tool

"I doubt if you have ever called upon the builders to produce a line of machine tools suitable for railroad shop work," Bill concluded. "I believe that the special tools you have today in use in your shops were almost entirely due to the efforts of the tool builders."

"The automobile builder does not start to purchase machines with a general 'what have you to sell' inquiry," said Tom, "but rather on the order of 'we wish a certain machine to perform a certain operation on the described piece within such and such a length of time.'"

"I wonder," said Bill, "if it would not be possible for you men, through your mechanical associations, to choose committees with a view of getting together with the builders to produce machines more especially suited for railroad shop work than some which are now purchased for that purpose?"

The performance of the tool depends on its fixtures

"Another thing," said Bill, "it seems that both the railroad users, as well as the tool builders would profit by the addition of certain fixtures to the standard machine making it adaptable to highly specialized railroad work. I will cite a single instance. In railroad shops where the shoe and wedge faces of driving boxes are refinished by planing you will see all kinds of attachments for securing the driving box in place on the machine. Some are remarkably good. Some, you might say, are indifferent, while others are woefully bad. The fact of the matter is that the machine-tool builder sells a planer, which is just a planer. No more. It may be a good planer, but when harnessed to the work by some makeshift contraption, the planer falls a long ways short of giving a satisfactory account of itself. You can carry that thought as far as your necessity requires you. My personal opinion is that if it is worth while to

specialize in raising hens, it is worth while to consider specialized railroad tools for railroad shops. Take it for what it is worth. A farmer's views on the subject may be of some scant value. On the other hand they would at least give you a chance to get by on the job you admitted to be beyond you."

"Listens good," said Highball. "What do you think, Tom"?

"I believe the suggestion is worthy of consideration," replied Tom James. "And now that we have settled the machine tool problem, let's go out and select the shrubbery which I came up here to buy."

Three devices for the air brake shop

By J. E. Page

Machinist, Atlantic Coast Line, Montgomery, Ala.

WHEN repairing air brake equipment, it is often necessary to devise special tools with which to expedite the work by making difficult tasks easy. The three devices shown in the illustrations have aided considerably in making better and quicker repairs to the parts for which they are intended.

Fig. 1 shows a device for testing air compressor

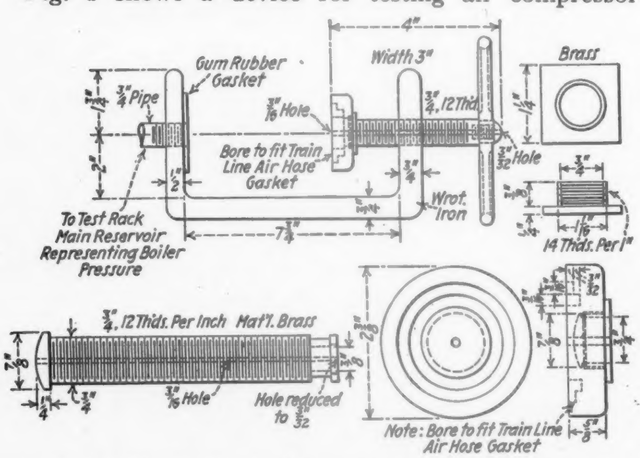


Fig. 1—Device for testing repaired air-compressor governors

governors after they have been repaired. The device consists of a channel-shaped frame in which the governor is held. The governor is held in position by tightening a square-threaded bolt on the end of which is a fitting bored to fit over the train-line, air-hose gasket.

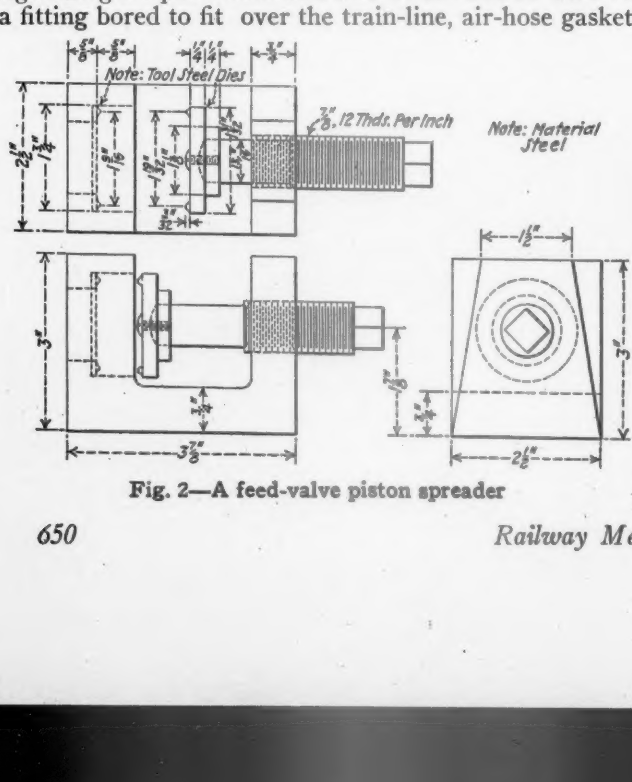


Fig. 2—A feed-valve piston spreader

A pressure corresponding to that built up on a locomotive is obtained by building up the shop air pressure to the desired amount. In this manner the governors can be set so that after being placed on the locomotive, they will not vary more than 1½ lb., which amount requires only a small adjustment.

The old method of increasing the diameter of a feed-valve piston by using a hammer and set has proven, through experience, unsatisfactory, as a glancing blow of the hammer results in the piston being left larger on one side than on the other, thus causing a sluggish feed

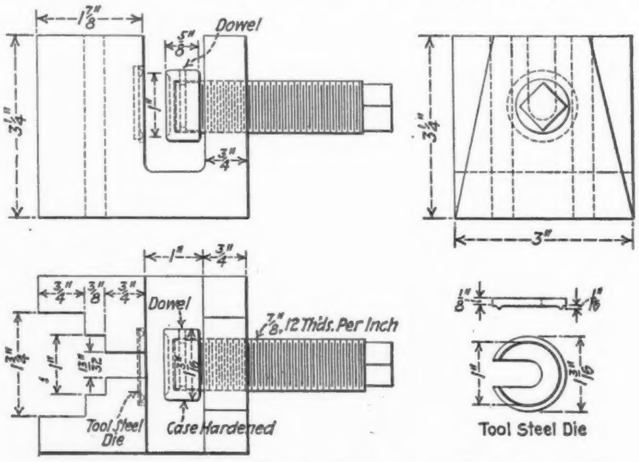


Fig. 3—A simple device used for spreading feed-valve piston wings

valve. The device shown in Fig. 2 eliminates this common source of trouble. The tool steel dies make only a small impression on the edges of the piston, pressing out each side to the uniform size of .004 in. or .005 in. oversize.

After feed valves have been in service for some time, the wings or guides are found to be worn off on the edges, thus allowing the piston to cock in the feed-valve cylinder which condition interferes with the proper functioning of the feed valve. By placing the wings in the device, shown in Fig 3, and making a light impression, a uniform increase of from .004 in. to .007 in. in diameter is obtained.

* * *

Top—First hopper car of Schoen design, built with pressed steel shapes in 1897; Bottom—The same car in 1928—This car is now on exhibit at the Greenville, Pa., shops of the Bessemer & Lake Erie

Small tools developed at Maine Central shops

Special reamers, end mills and jigs designed to expedite locomotive repairs

ALL the locomotives of the Maine Central receive class repairs at the Waterville, Me., shops where an average of from 10 to 12 locomotives a month is overhauled. In these shops a special effort is made to encourage the workmen to develop better methods or special tools with which to expedite different repair jobs and, as a result, many small tools have been developed which can be used to advantage in most any locomotive repair shop.

Boring tools and jig used for a feedwater heater job

The Maine Central, like many other railroads, is now equipping many of its locomotives with feedwater heaters. One of the difficult jobs encountered when installing feedwater heaters on locomotives is that of cutting the pipe connections for the heater in the cylinder saddle. The tools and jig, shown in Figs. 1 and 2, have made, what would otherwise be a difficult job, a comparatively easy one. A 1¾-in. pilot hole is first drilled into the cylinder saddle, after which a boring tool is used to enlarge this hole to 5 in. in diameter. The tool used consists of two parts, one of which is the arbor on the end of which is screwed a hollow end mill.

The arbor consists of two main sections—a No. 4 Morse taper shank at one end and a 1¾-in. pilot bar at the other—which fits into the pilot hole drilled into the saddle. The pilot bar extends ⅜ in. beyond the face of the end mill, which is made of high-speed tool steel and contains a 2-in. threaded hole into which is screwed the arbor. Spaced equidistantly around the outer circumference of the end mill are 28 alternate angle teeth.

Before the seat is milled in the pipe connection hole, four holes must be drilled and tapped in the saddle. The four studs screwed into these holes are used to hold the end of the steam pipe firmly into its seat in the saddle.

These holes are located by a jig which has a 1¼-in. diameter hole drilled through the center. A bolt, with a strap on the end of it, is passed through this hole and drawn tight against the inside of the saddle to hold the jig in position. Four 1¾-in. countersunk holes are spaced 90 deg. apart around the jig on an 8½-in. diameter circle. Two sets of hardened steel bushings, four for each set, are made to fit in these holes and are held in place by ⅜-in. set screws. One set of bushings, which measures ¾ in. in diameter, is used as a guide when drilling the four holes. This set of bushings is then replaced with the second set, which measured ⅞-in. in diameter. These bushings are used as a guide for the four ⅞-in. stud taps.

After the stud holes are completed, the 6½-in. diameter counterboring tool—similar in construction to the 5-in. tool—is used to mill the pipe connection seat in the cylinder saddle. This set of tools has reduced by 50 per cent, the time required to machine the cylinder saddle steam pipe connections for feedwater heaters.

Special purpose facing and reaming tools

A special adjustable, inserted-blade, facing tool, used for facing in one operation the Walschaert link cheek

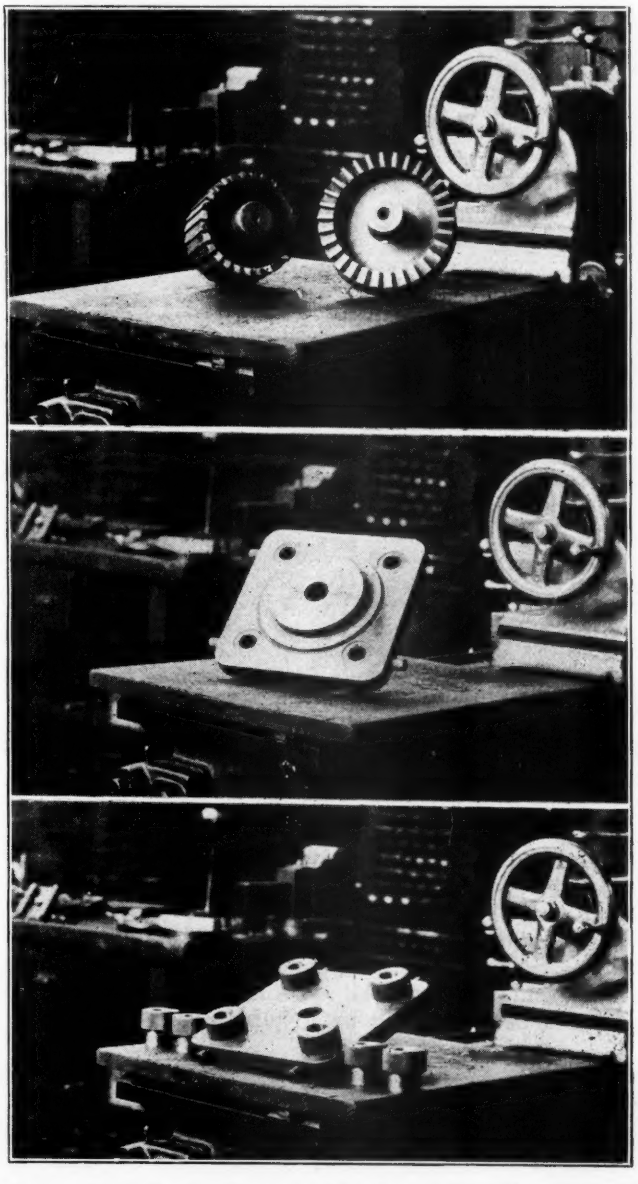


Fig. 1—Top: End mill type of boring tool used for cutting feedwater heater connection holes in the cylinder saddle; Center and bottom: Jig used for drilling and tapping four stud holes for the pipe connection

pins and hubs, is shown in the two views at the left of Fig. 3. The tapered shank fits into the spindle of a No. 4 Cincinnati plain knee-type milling machine. A 3-in.

hole is bored into the tool head, which is 5 in. in diameter. Four U-shaped high-speed steel cutters are spaced 90 deg. apart around the circumference of the head. These cutters are made from ⅝-in. square tool steel and are 1¾ in. wide and 1¾ in. high with a ½-in. gap between the cutter blades. The cutters are driven into ⅝-in. square holes, cut in the tool head. The cutters are held in place by ½-in. set screws. The cutter blades can be adjusted to face hubs ranging in diameter from 2 in. to 2¾ in., the range of the adjustment depending on the length of the blades. This tool has increased production 25 per cent.

The two views at the right of Fig. 3 show a four-blade self-centering reamer and counter-borer, which differs from the standard tool of this type in that it has four blades and does not require a pilot on the end to center the tool. The four blades are held in the body of the reamer by four segments that are tapered on each side. These segments bear against the side of the reamer blades and when drawn in tight by screws, firmly hold the blades in position. The ends of the four blades are tapered, which eliminates the use of a pilot to center the reamer. The use of four reamer blades, instead of three, is for the purpose of preventing chatter, the elimination of which results in a smoother finish in the part reamed.

The usual type of general purpose reamer contains ten blades welded in place and when worn out, the tool has to be discarded as the blades cannot be renewed. The reamer, shown at the top of Fig. 4, is designed so that the blades can be easily removed for grinding or renewal. The body of the tool is made from

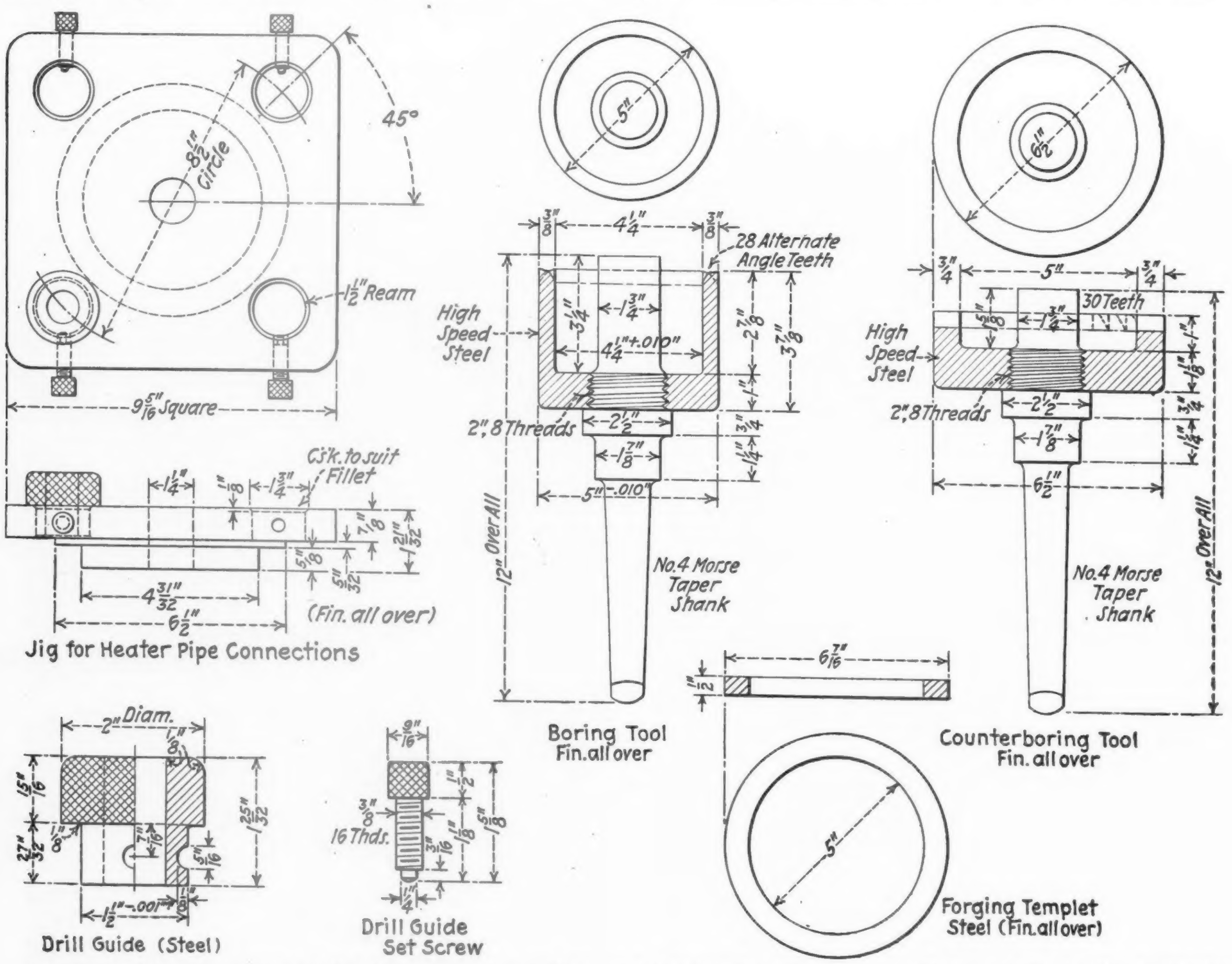


Fig. 2—Detailed drawings of the tools used for cutting and tapping the holes in the cylinder saddle for the feedwater heater pipe connection

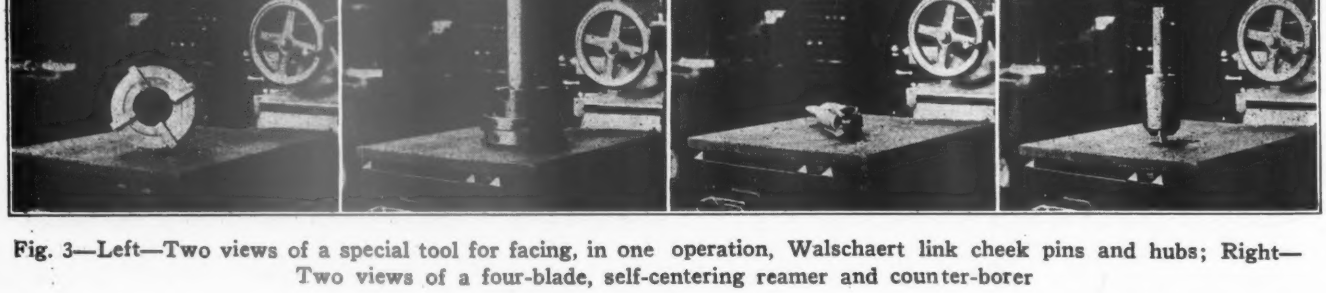


Fig. 3—Left—Two views of a special tool for facing, in one operation, Walschaert link cheek pins and hubs; Right—Two views of a four-blade, self-centering reamer and counter-borer

soft steel with ten 3/16-in. wide slots machined around the circumference of the reamer body. In each ot these is placed a reamer blade, 3/16-in. wide across the cutting edge and ⅝ in. thick. These blades are offset at each end so that a collar will fit over the ends. These two collars, when drawn up tight, are locked into position by two 5/16-in. set screws firmly holding the blades in the slots. A No. 4 Morse taper shank is provided to fit the spindle of a motor or a drilling machine.

Usually a solid-piece reamer is used for reaming

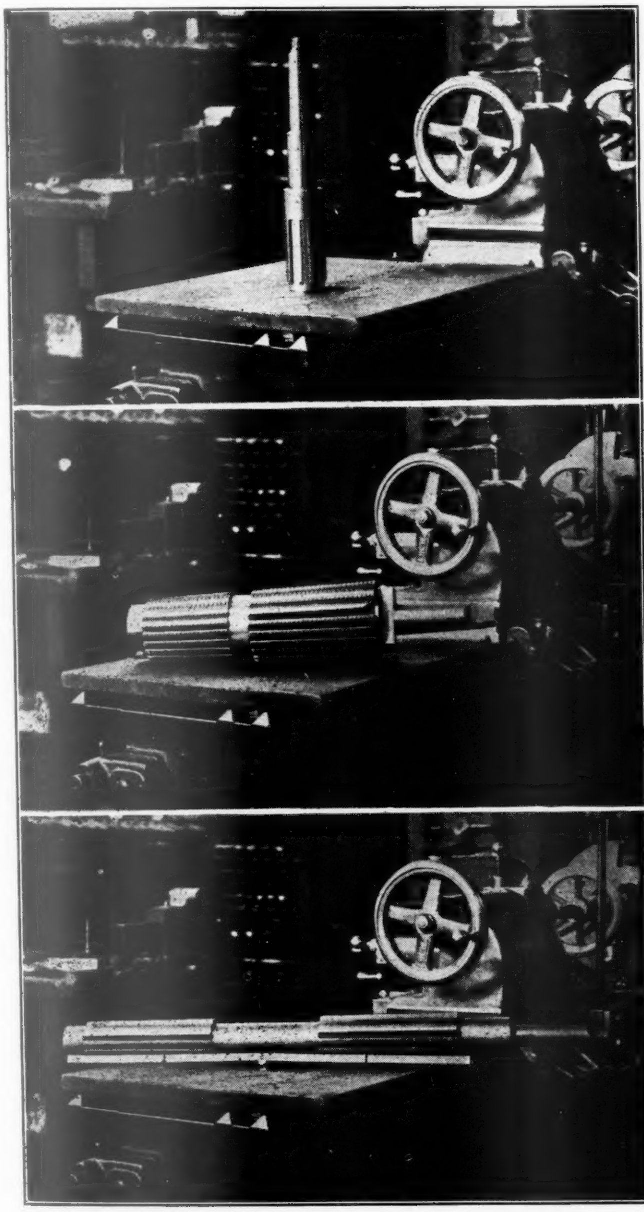


Fig. 4—Top—General purpose reamer with removable blades; Center—Special tool for reaming crosshead wrist-pin fits; Bottom—Tool for reaming the bell-crank pin hole in a Baker valve gear

wrist-pin fits in a crosshead. When the reamer blades are worn out on this type of a reamer, the tool has to be thrown away. Furthermore, no provision is made for reaming only one of the holes in the crosshead, which is often necessary when only one of the holes is found to be worn. The crosshead reamer, shown in Fig. 4, is designed to eliminate this source of trouble. It consists of an arbor on which are placed two shell reamers. The shells are properly spaced on the arbor by a ferrule placed between the two shells and held on the arbor by a taper pin that passes through the shell reamers and the body of the arbor. A large hexagon nut on the end of the arbor also helps to hold the shells in place. If it is desired to ream only one hole in the crosshead, one reamer is replaced with a blank bushing. Different sizes and tapered shells can be placed on the arbor, which eliminates the necessity of keeping on hand a wide variety of reamers for different sizes of crosshead wrist-pin fits. The arbor is fitted with a No. 5 Morse taper shank so that it will fit a drilling machine.

Some of the Maine Central locomotives are equipped with the Baker valve gear. When this valve motion is repaired, it is often necessary to ream out the bell-

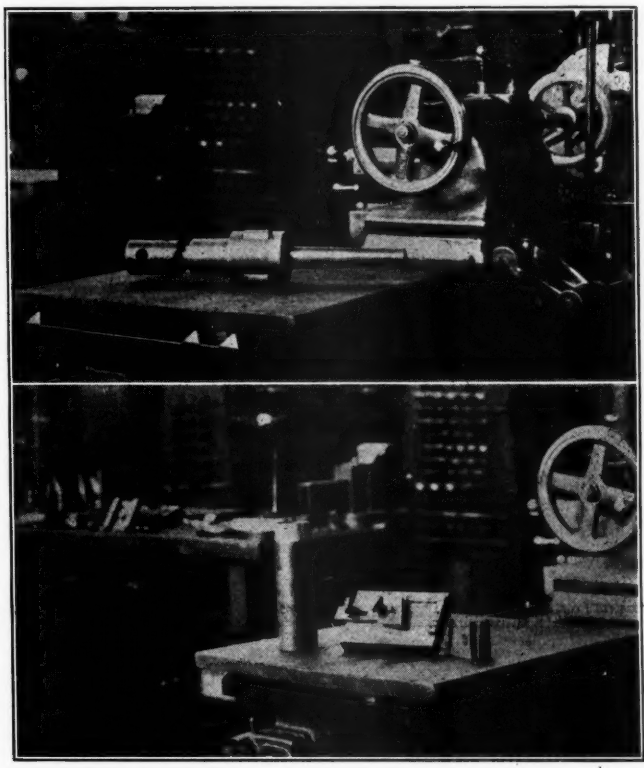


Fig. 5—Top—A tube expander designed to reduce wear in the roller slots; Bottom—A jig used for uniformly grinding a set of safe-end scarfing cutters

crank pin hole. The work is done with an adjustable double-shell reamer, shown at the bottom of Fig. 4. The reamers are adjustable on the arbor by placing different lengths of ferrules between the shells. The taper-pins which pass through the reamer shells and the body of the arbor, and also a nut on the end of the arbor, hold the reamer shells in place. The reamer may be driven by either a ratchet or an air motor.

A tube expander

When using the conventional type of tube expander, the rolls, when fully expanded, rub against the edges of the roll slots with the result that the slot openings are worn wider than the diameter of the rolls, thus eventually permitting the rolls to fall out. The tube expander, shown in Fig. 5, has been designed to prevent any wear against the edges of the roll slots. The diameter of the rolls has been increased a sufficient amount so that the center of the rolls is below the center line of the slot. Thus, when the rolls are fully expanded, they will not bear against the edges of the

slots, thus preventing slot wear. This slight change in the design of this tool has materially increased its useful life.

The cutters used for scarfing flue safe-ends are made from discarded bolt thread chasers. It is necessary, when grinding a set of four cutters, that all be ground exactly alike. One cutter is ground to the required dimensions, after which it is placed in the jig, shown at the bottom of Fig. 5. This jig is adjustable so as to hold any length of cutter and can be set at any angle.

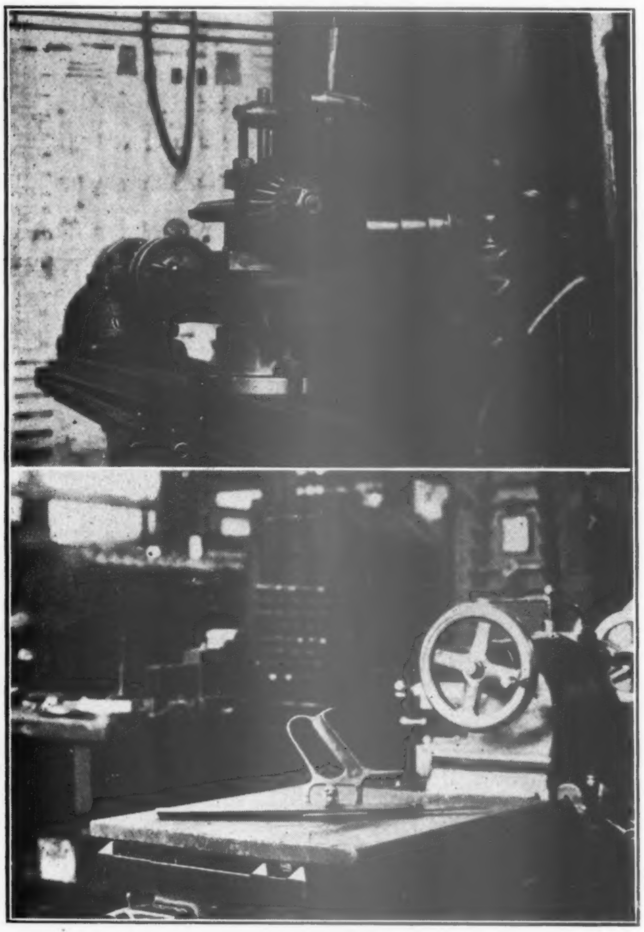


Fig. 6—Top—Fixture for grinding ball-seat end mills; Bottom—A device for holding a flat file

After the jig is set to the first cutter ground, the remaining three cutters of the set are ground to fit the jig setting. Through the use of this jig, all of the cutters are ground alike and maximum usage is obtained from a set of cutters.

Attachment for grinding ball-seat end mills

It is often difficult to accurately grind the flutes on a ball-seat end mill. The reason for this is that the end mill cannot be swung through a radius that will accurately correspond with the radius of the flutes. The device, shown at the top of Fig. 6, makes it a comparatively easy task to swing the end mill through any desired radius. The device consists of a discarded compound tool-rest, mounted on a swivel base. The end mill is held in a vee-block bolted on the top of the compound rest, the cross slide of which is graduated in inches so that any size of end mill common to railway shops can be ground on this device. After the cross slide has been set for grinding the correct radius, the end mill is swung by hand through the proper radius. A cup grinder is used for this work.

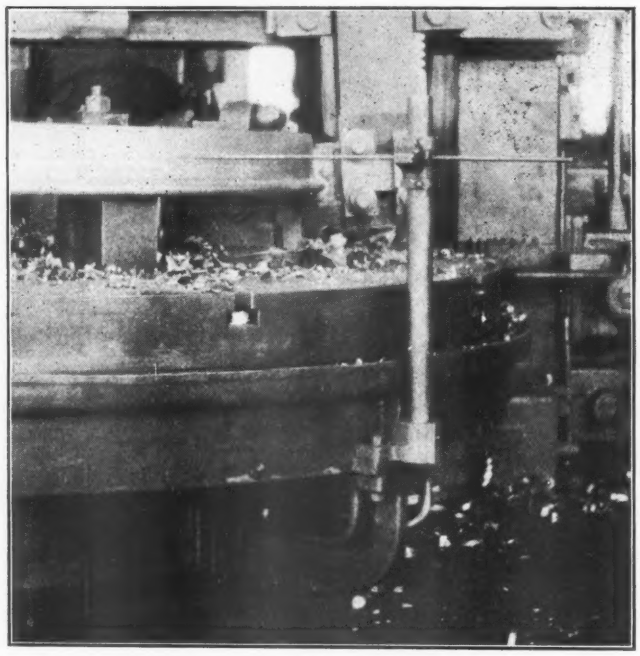
It is a difficult task to file a large flat surface unless some means is provided to hold the file so that all of its surface can be used with each stroke. The holder, shown in Fig. 6, is designed to hold any size of flat file and also provides a natural hand grip which makes easy the tedious task of using a file for any length of time.

Jig for calipering tires on a boring mill

By G. N. Cagle

General machine foreman, Central of Georgia, Macon, Ga.

THE device shown in the illustration is used for calipering driving-wheel tires on a boring mill. It was designed to eliminate the use of the customary wooden calipers that are found in practically all locomotive repair shops. It was found that wooden calipers did not give the accurate measurements desired and also that considerable time could be saved by using this jig. The new calipering device consists essentially of a vertical arm and a horizontal pointer which can be adjusted to suit. It is bolted to the revolving table of the boring mill, as shown. It was made in the tool room of the shops and was applied to the machine, using bolt holes that were already in the machine. Since this device was placed in operation it has been found to be more accurate, more easily set and more convenient for the use of the operator than a pair of wooden calipers.



View showing how the jig is attached to the machine

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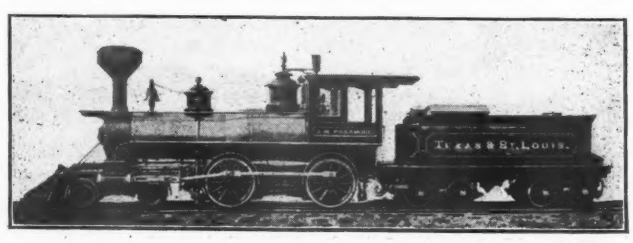


Texas & St. Louis three-foot gage locomotive built in 1879—Cylinder, 12 in. by 16 in., diameter of drivers, 42 in.

The Reader's Page

Have You a Question? Ask it
Have You an Opinion? Express it

In defense of the slotter

ALLSTON, MASS.

TO THE EDITOR:—

There are many who are not aware of the possibilities of the slotter as a tool for general railway repair work, or for railway production work. The attitude toward the slotter can, in all probability, be attributed to the fact that when we go through many railway shops we find slotters of the vintage of 1876. It is not unusual to find a slotter equipped with a fly-wheel on the traversing shaft in place of the modern crank. Recently, I watched the operator of one of these ancient slotters. He labored and turned at the fly-wheel and after about fifteen minutes of hard work, was finally able to get the table into the desired position.

In another case, a new driving box was designed that required the crown brass seat to be machined to a taper fit. The machinist in charge of the slotter on which the boxes were to be machined, finally, after much deliberation as to how to do the job, removed the cross-table jib and wedged up one edge of the slide so that the upper rotary table set at an angle. Thus, upon rotating the table, the proper taper fit was secured.

While we must admire the cleverness of the operator, what is our opinion of the railway officers who permit such a machine to remain in a railroad shop? A slotter provided with an adjustable ram slide that can be quickly set at any desired angle would soon pay for itself on such work. A modern, high-speed fully-equipped slotter is a heavy-duty production machine that excels many other types of machine for handling driving boxes, crown brasses and various other locomotive repair parts.

Modern tools, modern fixtures and modern machines go hand in hand. I often wonder why so many railroads are paying dividends.

F. RATTEK.

What do you think?

ONE of the important jobs of the mechanical department supervisor is selecting shop tools and equipment for recommendation when new equipment is to be purchased. Are records of the performance of existing equipment of any value in making selections? Without such records, how do you convince your superior officer that your selection is the best?

Craft consciousness

MINDEN, LA.

TO THE EDITOR:

The case of Bill Kempt is a pitiful reality in most any department of railroad work and there is no real reason for it other than craft consciousness.

For instance, we'll say the general manager came up through the transportation department. He will almost invariably seek men for promotion amongst men in that department. Another example. The superintendent of motive power is a machinist and wants a master mechanic or general foreman. Does he go outside the ranks of his craft for this man? Scarcely ever.

Supposing he wants a man for a division mechanical foreman—a position requiring some knowledge of car department matters as well as of locomotive handling. Will he consider Bill Kempt, who is, sometimes, behind with his work, possibly due to the fact that he has been trying to familiarize himself with all the work pertaining to the mechanical department, or will he not rather pick the machine foreman, Jack Rennie, who is always up with his work on the machine floor? Do you think he will consider a man from the car department who may have been following the same lines as Bill Kempt? Scarcely ever.

A supervisor who is a specialist in his own line of work is an asset in any organization, but is, in a great many instances, slowed up when moved up to a position for them. Jack Rennie is the better man. Being a specialist, he is invaluable within his own line of work. To an organization which considers each man, in that organization, as timber for promotion, Bill Kempt is of more value to his company than any man who has no thought of other classes of work than that which he is immediately in charge of.

It is only natural for each foreman to consider the work he is in charge of as being the most important class of work in the shop, and feel that the other fellow is incapable of handling it. That is craft consciousness, and most of us are afflicted with it, from the highest to the lowest.

J. B. SEARLES.

Developing labor-saving devices in the shop

LORAIN, OHIO.

TO THE EDITOR:

Your editorial in the *Railway Mechanical Engineer* for September, 1928, on the question of rewarding the originators of means for increasing output or effecting savings, should be of particular interest to all railroad officers. A feature of any man's temperament is that which demands some recognition for any special service rendered, a demand rendered more emphatic, as a result of our so-called modern methods of service.

I had hoped before this to have seen some comment from readers of your columns whose opinions would probably be of greater value than that of a private in the ranks. The question was put to a number of intelligent, practical railroad mechanics and 99 per cent came back with the answer, "The man should be rewarded—not with a pat on the back or just a kind word, but with something that would help to fatten the

kitty." One answered, "Yes, he should be rewarded, provided he has worked out the idea on his own time, but,"—and here he dubiously shook his head—"I don't see how he has time for anything else but the work in hand."

Supposing we have a machine turning out 50 finished bolts per hour, and the operator is one of the wide-awake kind who works out a scheme whereby the output is increased to 60 bolts per hour. Naturally he knows that the increased production is all to the benefit of the company, and he is also intelligent enough to know that some of the savings should come his way. How shall he be satisfied that the company's idea of the reward he shall receive is right?

My suggestion is that the company have experts in appraising production values, estimate the amount of savings effected for the company during one year's production from that machine through the use of the operator's device and then offer the operator two-thirds of the savings for one year as the price of his idea. If that does not satisfy him, nothing short of a seat on the board of directors will.

JOSEPH SMITH.

Pulverized coal burners in Germany

ELIZABETH, N. J.

TO THE EDITOR:

I read with interest the article in the September *Railway Mechanical Engineer* describing a pulverized-coal-burning locomotive built in Germany. It has been something of a puzzle to me for sometime past as to why the use of pulverized coal on steam locomotives has not been given more serious consideration by the officers of the mechanical departments of railroads in the United States because of the saving in fuel and other benefits which could be effected by its use.

A typical heat-balance for a large modern hand-fired locomotive boiler, when being worked at nearly its full capacity is as follows:—

Heat utilized in evaporation, per cent	57.5
Heat lost by:	
1—Coal escaping unburned, per cent	28.5
2—Sensible heat in smokebox gases, per cent	10.3
3—Imperfect combustion, producing CO, per cent	0.9
4—External radiation and other minor causes, per cent	2.8
Total heat in coal fired, per cent	100.0

This shows an overall boiler efficiency of 57.5 per cent. In other words, nearly one half of the total heat in the coal fired is wasted when the boiler is being worked at the rate of the test from which the above figures were obtained. In general, when the rate of working decreases the boiler efficiency increases and vice versa. The largest single item of heat loss and the one which changes most with the rate of working is the loss due to coal escaping unburned, amounting to 28.5 per cent in the above case.

The primary causes of this loss are improper mixture of coal and air in the combustion zone, the lowering of the firebox temperature by the large amount of excess air required, and the carrying of particles of fuel out of the firebox and into the flues, and front end before they can become completely burned. This condition is aggravated at high rates of working by the terrific draft necessary to furnish enough air to burn the required amount of coal.

The use of pulverized coal in a properly designed firebox practically eliminates the heat loss due to fuel escaping unburned and ought to increase the overall boiler efficiency from 10 to 25 per cent, depending on the rate of working, kind of coal used, etc. The reasons for this are that the coal enters the firebox in a finely divided state, intimately mixed with air; the firebox temperature is higher than in the grate-fired boiler, insuring more rapid and complete combustion, and the amount of excess air required is greatly reduced, allowing the use of a lighter draft for the same combustion rate.

A reduction in the amount of fuel escaping unburned is, however, not the only benefit to be derived from the use of pulverized coal in steam locomotives. The cheapest grades of coal may be used; the rate of combustion can be easily controlled to suit the rate of working of the boiler; the cost of cleaning fires is eliminated, and stand-by losses are reduced by the elimination of the cost of maintaining banked fires during lay-over at engine terminals. Also, there is a great reduction in the amount of smoke produced and a general improvement in working conditions on the locomotive and in the enginehouse.

These benefits and savings would be offset to some extent by the first cost of the necessary pulverizing plants and the rather expensive equipment on the locomotive, and also by the somewhat higher maintainance costs of the pulverizing plants and locomotive equipment. But in spite of this, it seems to me that the pulverized coal proposition looks attractive enough to warrant the expenditure of some money and effort by the railroads in overcoming the few mechanical difficulties which, at present, seem to prevent its more general development for locomotive use.

NICHOLAS M. TRAPNELL.

REVOLVATORS.—Bulletins 83A and 83B of the Revolvator Company, 336 Garfield avenue, Jersey City, describe the new revolvable base and enclosed gear and splash system lubrication features of Revolvator equipment.

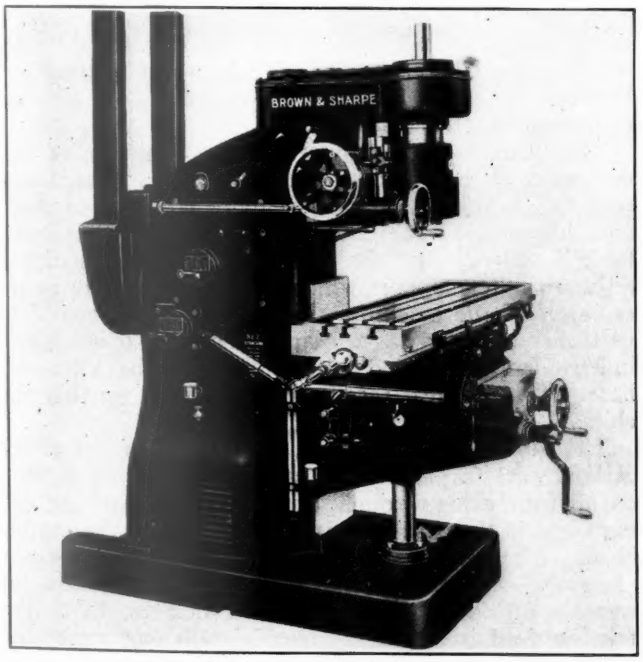
TOOLS FOR FLAT TURRET LATHES.—The new 52-page, board-bound catalogue of the Jones & Lamson Machine Compnay, Springfield, Vt., is divided into three sections, the first two of which illustrate and describe standard bar and chucking outfits, respectively. The third section contains information regarding additional standard equipment not included in regular outfits.

* * *

One of the pictures shown at the American Car & Foundry meeting of the New York Railroad Club, March 16, 1928—Power welding machinery in the plant, at Carbondale, Pa.

Internal milling head for thread millers

A MILLING head, designed for internal milling and hobbing by the Pratt & Whitney Company, Hartford, Conn., can now be obtained for use on either the Pratt & Whitney 6-in. or 10-in. Model B thread millers. Application of this head virtually converts the thread millers into universal machines, as the regular cutter head of the machine will handle all external milling and hobbing, and the milling head will complete all internal milling and hobbing. The head is so geared that the speed of the cutter spindle is practically doubled over the speed of the external cutter head, owing chiefly to the fact that small milling cutters can be used on almost all internal work.



The Brown & Sharpe standard vertical spindle milling machine

The base is dovetailed to fit on the cross slide with the regular external cutter head. The milling head is locked in position on the cross slide by a lock bolt equipped with check nuts, which fit into a tapped hole in the base casting of the external cutter head. This arrangement permits the use of the cross-slide handwheel for the transverse movement of the external head and internal head simultaneously.

Power is supplied to the head by a gear mounted on the cutter spindle shaft of the external cutter head, and through two intermediate gears to the cutter spindle of the internal head. The gears in this drive are Maag cut to insure smooth running action and good wearing qualities. Sight-feed oilers provide continuous lubrication to this gear train.

The head spindle is mounted in bronze bearings and is equipped with a flywheel.

An adjustment is provided for setting the cutter at any angle up to 10 deg. above or below the center line. The angle of the cutter can be set quickly as graduations are provided on the side of the milling head for this purpose. Sturdy tie rods are used for holding the cutter arbor at any given angle within the range of the milling head to prevent slippage. The angular setting of the cutter, above or below the center line, is an advantage when milling either right-hand or left-hand threads.

A heat insulating material

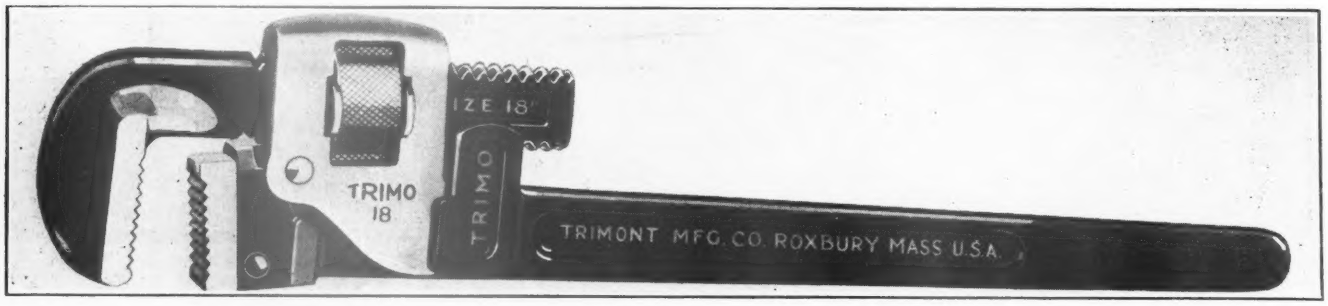
AN insulating material, called Torfoleum, which is being introduced in this country is said to be adapted specially for all classes of heat insulation up to temperatures of 230 deg. F. This product, which at the present time is manufactured in Germany, where it has had extended use, is handled in this country by Pennrich & Company, New York.

Torfoleum is manufactured from peat moss which has been treated by a special water-proofing process, and is furnished in sheets 19½ in. wide by 39 in. long, with thicknesses ranging from 1 in. to 6 in. It has a finely pored texture and weighs less than 1 lb. per board foot. This material is said to have a high compressive strength and low thermal conductivity, to be waterproof, non-capillary, rot-proof, fire retardant and free from harmful odor.

Its principal uses are for the insulation of refrigerating plants and refrigerator cars, and for practically all kinds of building construction. It can be readily cut or sawed and secured in place either by nails or adhesive materials. This material is also said to have efficient sound-absorbing qualities.

Pipe wrench specially heat treated

THE Trimont Manufacturing Company, Inc., Roxbury, Mass., has placed on the market a pipe wrench, the strength of which has been increased through a special process of heat treatment. Although not materially changed in appearance, has been considerably strengthened. Additional strength has been provided by overlapping side lugs, an integral part of the handle, which brace the frame against lateral distortion or spreading. The design of these re-inforcing lugs furnishes a safety feature without hampering the action of the frame or adding to the bulk of the wrench.



The Trimo pipe wrench which has been considerably strengthened

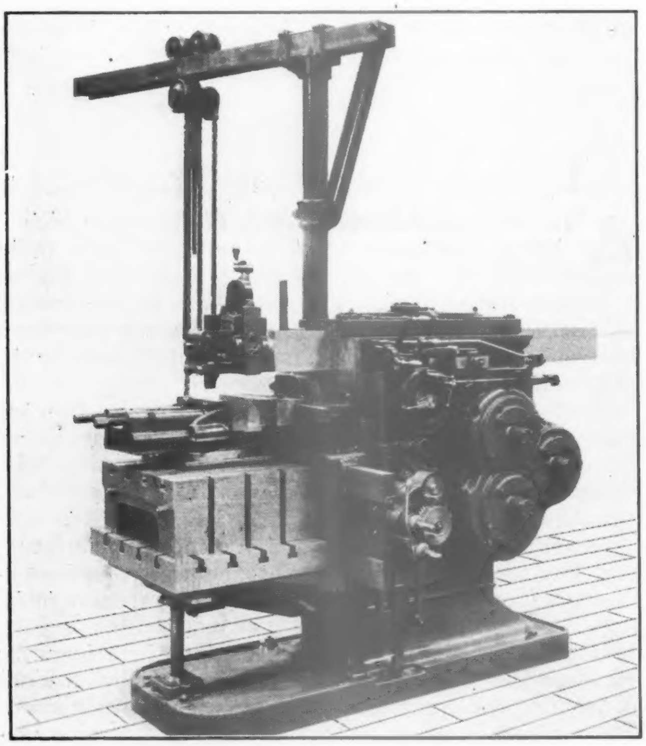
the contour of the frame has been slightly extended, the parts of the old design and new design wrench are interchangeable throughout.

A newly developed method of heat treatment gives the handle greater strength and toughness than that of the previous designs. The swinging steel frame, though

The wrench is provided with an insert lower jaw and nut-guards which protect the adjustment.

Morton 32-in. stroke draw-cut shaper

THE column of the 32-in draw-cut shaper, manufactured by the Morton Manufacturing Company, Muskegon Heights, Mich., is of box type and heavily constructed. It is provided with square rail bearings and all running journals are closely fitted and bolted. The crossrail is fitted to the square rail bearings on the column and is provided with gibs for compensating for wear.



The right side view of the Morton 32-in. draw-cut shaper, showing the vise on the knee

The lower table and outer support, which is of new design, is of the angle-bracket type and is located considerably lower on the saddle, giving 31½ in. of clearance between the ram and the lower table. The lower table is supported at the outer end by an automatically adjusted outer support which is secured directly to the crossrail of the machine. It is raised and lowered by vertically adjusted large diameter screws operating in independently adjusted nuts bolted to the extension base. Two vertical feed screws are used on this machine.

The ram is 6 in. by 6½ in. and is made from a high carbon steel forging. The ram has a bearing surface on all four sides through the entire length of the column and is threaded on one end to receive the cutting head. The clutches, reversing mechanism for operating the clutches, and the stroke adjustment are the same as on other Morton draw-cut shapers. The new friction feed is of the automatic relieving type and especially constructed with a large friction surface.

The splash system of oiling is used for the clutches and all shafting journals which are subjected to heavy cutting strains. The adjustable back bearing forms a stop against which work may be placed when held in the vise or otherwise. This bearing transfers the thrusts of the cut directly against the column of the machine.

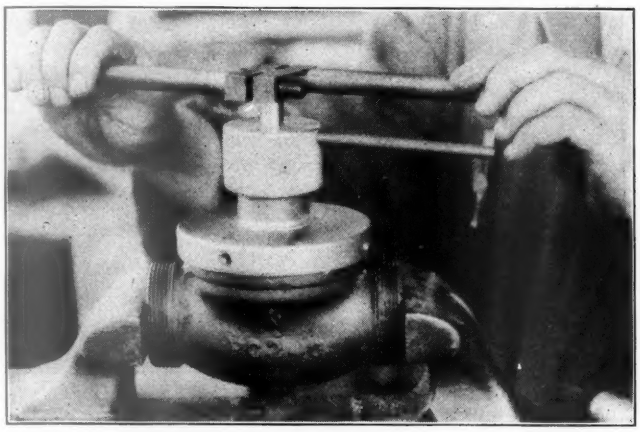
The machine is equipped with a ½-ton capacity independent crane and hoist of the two-speed type. It is also equipped with a standard steel head, swivel-base vise with a 14-in. opening, a large tee-slotted top plate,

28 in. by 32 in., for bolting large work, and it can be furnished either belt or motor driven. It will also accommodate the Morton shell-planing shoe and wedge and rod brass attachments for railroad work.

The machine has a 32-in. cutting stroke, a 32-in horizontal feed on the table and a 16-in. vertical table feed.

Governor steam valve reseating tools

THE illustration shows a tool for facing and reseating valve seats in pump-governor steam valve bodies. These tools are made by the Foster Johnson Reamer Company, Elkhart, Ind., in two sets—one for 1¼-in. steam valve bodies and the other set for 1½-in. valves. Each set consists of two tools—one cutter



Reaming a pump-governor valve seat

boring tool for facing the top of the seat and bringing the 45-deg. face to the desired width, and one regular reseating tool for reseating the 45-deg. valve seat. A long bearing is provided in the adapter for guiding these tools and to give long and efficient service.

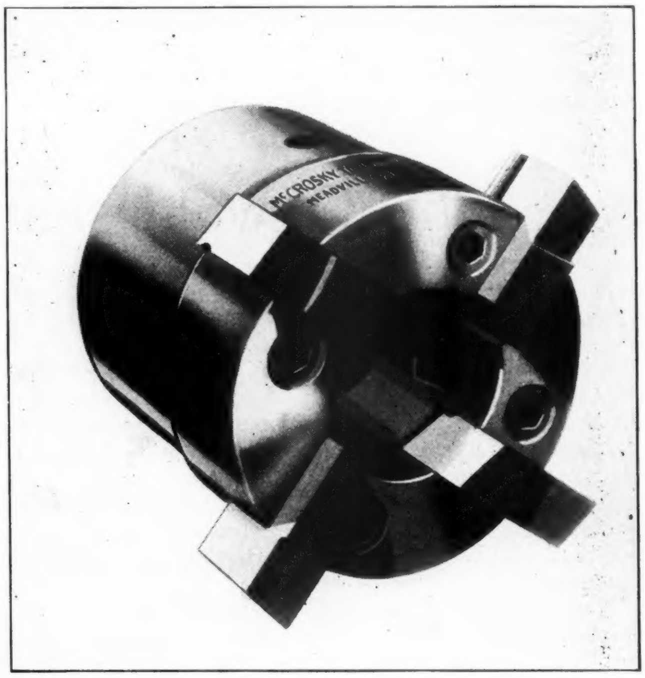
Foster-Johnson tools are also furnished for use in reaming pump-governor steam cylinders. The reamers for this particular work are available in 2¼-in., 2¾-in. and 3-in. sizes.

McCrosky four-point boring head

A FOUR-POINT boring head in which the four high-speed blades are rigidly locked in a hardened steel body has been placed on the market by the McCrosky Tool Corporation, Meadville, Pa. There is a groove in the blade to receive a drill-rod pin which is also imbedded in a groove in the body. A hollow set screw bears against the pin and forces it tightly into the groove of the blade. This combination locks the blade tightly and rigidly in the body and permits the head to take an unusually heavy cut.

This design offers an unusually large radial adjustment. A head 3 in. in diameter has an adjustment of ¼ in., and a head 6 in. in diameter has a ½-in. adjustment. Adjustment for the other sizes is in proportion. The head can be made in sizes from 2½ in. up.

The large hole in the body of the head permits the use of a large sturdy bar. The head can be used to

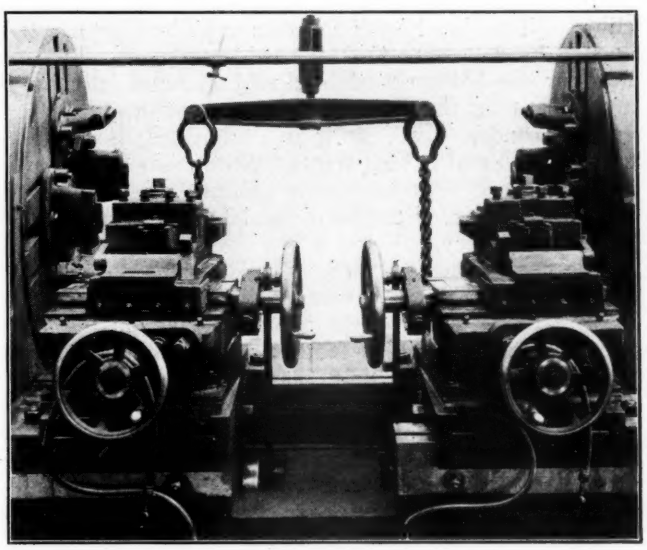


Four high-speed blades rigidly locked in the McCrosky four-point boring head

good advantage with a Shell reamer, mounted on a bar, for roughing and finishing in one operation.

Roller-bearing journal wheel sets handled on car-wheel lathe

THE chucking of roller-bearing wheel sets for tire turning in the No. 4 car wheel lathe, manufactured by the Niles Tool Works, Hamilton, Ohio, may now



A Niles No. 4 car-wheel lathe arranged to handle wheel sets equipped with roller-bearing journals

be just as readily accomplished as the chucking of plain journal sets. Changes in the tool rests and bed

have been made in this machine which make it equally adaptable for either type of bearing.

Inasmuch as it is impractical to remove the roller bearing housings from the journals, the wheels cannot be chucked by split bushings, but are mounted on centers in the sliding spindles. It is necessary only to remove the end cover plate to expose the centers in the axle.

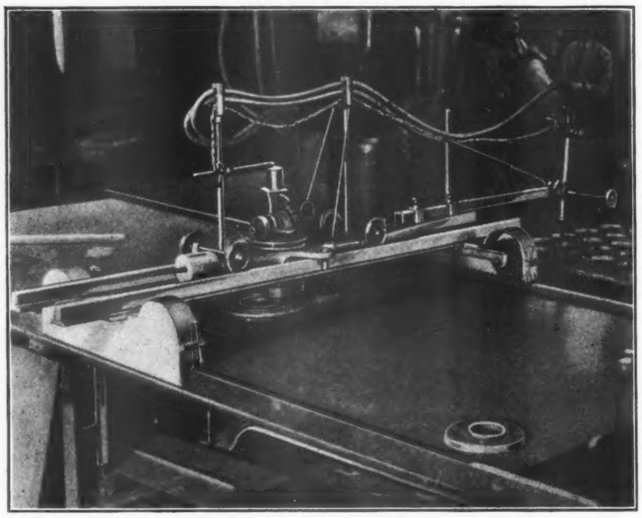
This method of chucking demands some lateral adjustment of the tool rests along the bed to bring the cutting tools opposite the wheel treads, owing to the greater distance between faceplates when the axles are held on the centers. Each tool rest is, therefore, mounted on a sub-base having a small amount of lateral adjustment by a rack and pinion.

The Oxweld shape cutting machine

An automatic oxy-acetylene shape-cutting machine, designed to cut different shapes from steel plate, sheet metal, forgings, billets or ingots, has been placed on the market by The Linde Air Products Company, 30 East Forty-second street, New York. In this machine the cutting blowpipe is mounted on a carriage which is moved in any direction by an electric motor. For routine production it will operate automatically from templets. In cases where only a few parts are to be cut out, a hand tracing device can be attached and used to follow the outline of a sketch or blueprint.

The parts of the machine are sturdily built without impairing the delicacy of adjustment necessary in a precision instrument of this sort. The rigid construction and unique design prevents lost motion and makes the cutting accurate in every case.

The machine requires but one operator. Little machining is necessary in most cases after cutting because the parts are produced with straight corners and smooth faces. The speed of cutting is high and ranges from 3 in. to 20 in. per minute, depending on the thickness of the metal. Accurate and smooth cuts can be made in stock up to one foot and more in thickness.



The Linde automatic oxy-acetylene shape-cutting machine

Die head for automatic screw machine

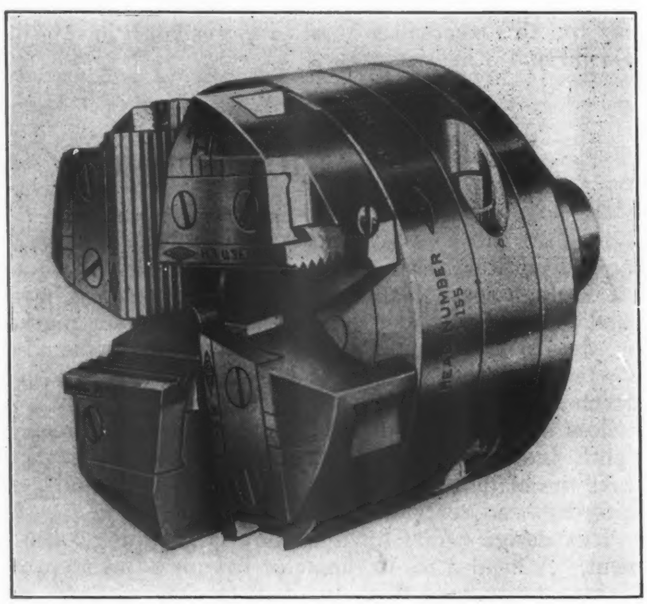
The Landis Machine Company, Inc., Waynesboro, Pa., has placed on the market a die head designed for application to automatic screw machines. This head is of the rotary pull-off type. It is opened by retarding the forward movement of the die head or die holders and is closed automatically by an attachment on the automatic screw machine.

The Landex head, as it is designated, is made of carbon steel and is heat treated throughout and ground. This has been done to reduce wear to a minimum and prolong the life of the head, and to insure a high degree of accuracy.

The head is flexible on its shank so as to compensate for any misalinement in the machine or in the work to be threaded. The chasers are supported on the front face of the head. This feature permits of easy access to the chasers when it is necessary to remove them for grinding and when changing from one pitch to another.

The die head employs an adjusting worm for adjusting the head to size. The adjusting worm is under the proper turning tension at all times, thereby eliminating the necessity of locking it for each adjustment for size. The adjusting worm has a micrometer dial for further adjustments for close or free fits.

The die head is locked within itself under service conditions by the engagement of two hardened closing pins and closing pin bushings. The head opening spring for opening the head is located in the adjusting ring. This spring has a tension uniform for all diameters.

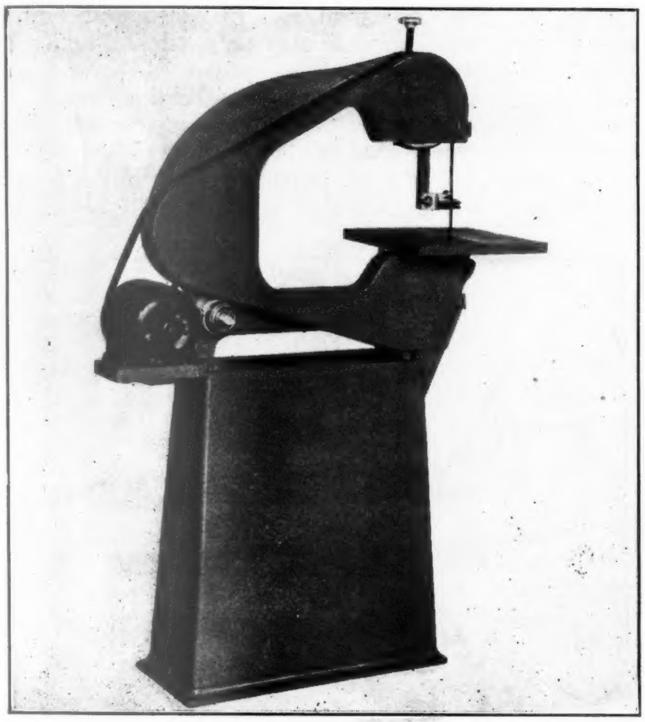


The Landex rotary pull-off type of die head for use on automatic machines

The Landex head is made in ½-in., 13/16-in. and 1⅛-in. sizes. The heads are graduated for bolt and pipe threads within their ranges. Each graduation is separate, one from the other, and has its own index mark on the operating ring. All passages and openings into the interior of the head are entirely covered under service conditions, making it impossible for dirt and chips to enter.

An adjustable portable band saw

THE band saw, shown in the illustration and recently placed on the market by the DeWalt Products Company, Leola, Pa., is designed to provide in a portable machine the power and handling capacity of a production stationary band saw. The machine is guarded to a maximum degree. The band saw above the floor standard is mounted in a one-piece cast housing which encloses the three tracking pulleys and the saw blade. The blade is entirely covered, except for the opening at the cutting point.



The De Walt portable band saw mounted on a sheet metal base

The feature of using three tracking pulleys instead of two large pulleys to separate the two sections of a revolving saw blade, has made is possible to design a compact machine with a 20-in. clearance in the throat between the saw blade and the frame and with a capacity to handle material up to 7-in. in thickness.

The entire machine, including the floor standard and the motor, weighs only 210 lb. Without motor and floor standard, it weighs 120 lb. The fact that the machine is portable does not in any way handicap it as a stationary unit.

This unit is preferably used as an individual motor-driven unit equipped with a motor and floor standard. However, the unit can be used independent of the motor and floor standard. It can be mounted on a DeWalt Wonder-Worker so as not to interfere with any other operation of that machine. By simply attaching the pulley on the arbor of the Wonder-Worker and swinging the arm to the rear, the band saw is ready to operate. By replacing the vee driving pulley of the band saw with a flat belt pulley, the unit can be driven from a line shaft.

The work table, which is 13⅝ in. square, tilts to the right 45 deg. and to the left 30 deg. A stop is provided to bring the table quickly to its horizontal position. A tracking device is provided to adjust the rollers so that the saw tracks are exactly over the rollers.

"Widia"—A hard cutting alloy

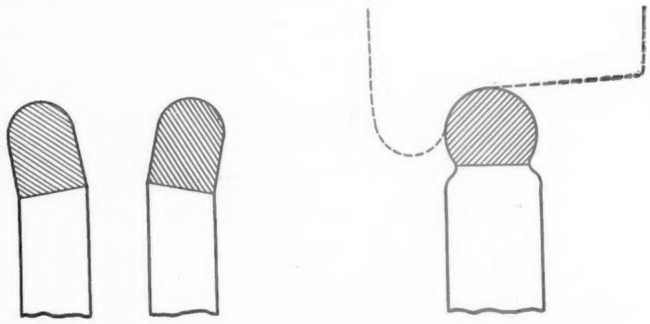
AN alloy for use in metal cutting tools has been placed on the market by Thomas Prosser & Son, 15 Gold street, New York. The alloy, which is not a steel, and the principal constituent of which is tungsten carbide, is a product of the Fried. Krupp Company, Essen, Germany. It is known as Widia, a term which is a contraction of the German words meaning "like diamond," and which is, in a measure, descriptive of the principal characteristic of the metal.

Widia is an extremely hard alloy which will not cut diamond, but will cut sapphire. It is manufactured ready for use, and requires no heat treatment. It is used in the form of small plates or bits which are brazed onto carbon steel tool shanks, and is furnished either in the form of completed tools or in bar form. A smooth, sharp edge is essential for the successful operation of the Widia tools and special carborundum grinding wheels are required to produce sharp cutting edges on this material.

Widia is tough, as well as hard, and it is the combination of these two qualities which gives the material its great cutting capacity. Not only will it cut manganese steel, chilled cast iron, glass, etc., but the edges of the cutting tools will stand up in turning pieces with irregular or intermittent surfaces and where the tool is repeatedly cutting through surfaces containing sand or slag. Widia tools are said to hold their cutting edges for long periods when machining soft or abrasive materials which repeatedly wear away the edges of ordinary tools. Hard rubber, Bakelite with metal inserts and commutators with insulation between the bars can be machined with these tools which are said to hold an edge from fifty to one hundred times as long as the other types of tools used in such service.

The cutting capacity of the tools is indicated by the fact that they hold their hardness and cutting edges even at a bright red heat, no change in the structure of the material taking place. The following examples illustrate the character of their performance on various

material: In cutting a 3½-per cent nickel steel, a Widia tool, operating at a cutting speed of 100 ft. per min., a feed of 1/8 in. and a cut of 5/8 in., stalled the lathe, which was driven by a 35-hp. motor, without damage to itself. A Carpenter No. 4 non-magnetic stainless steel 2-5/8 in. round, which showed a Brinell hardness of 228 and a tensile strength of 118,000 lb., was machined at a speed of 334 r.p.m., which equals a cutting speed of 230 ft. per min. The cut was .5 in. and the feed .17 in. per revolution. A bar of cast iron of 200 Brinell hardness, which was 11¾ in. in diameter and had two recesses 1-3/8 in. wide in the surface, was machined at a cutting speed of 665 ft. per min. The depth of this cut was .59 in. and the feed



Tire-turning tools with Widia tips—Left: Roughing tools—Right: Finishing tool

was .036 in. At this cutting speed, the number of blows on the edge of the tool was 400 per min. In another case, a bar of cast iron of 24 in. outside diameter and of approximately hexagonal shape, was machined with a Widia tool at a cutting speed of 240 ft. per min., which is four times the speed regularly used with other tools for the same cut and feed. On completion of the job, the edge of the tool is reported to have been in perfect condition, although repeatedly cutting into and out of the surface scale. These tools have been operated at cutting speeds and feeds high enough to cause the chips to leave the work at a light red color. This, however, is not recommended, although the tool itself will operate successfully, it is said, at a bright red temperature.

The principal requirements in the use of these tools are the protection against exposure to the air at temperatures high enough to cause oxidation. This requires care in the brazing of plates of Widia to carbon-steel tool shanks and in the grinding of the cutting edges. A limitation on the use of the metal is its inability to withstand the effect of dragging over the surface of the work without chipping of the edge. It cannot be used successfully, therefore, in planers or shapers, unless provision is made to lift the tool entirely clear of the work on the return stroke.

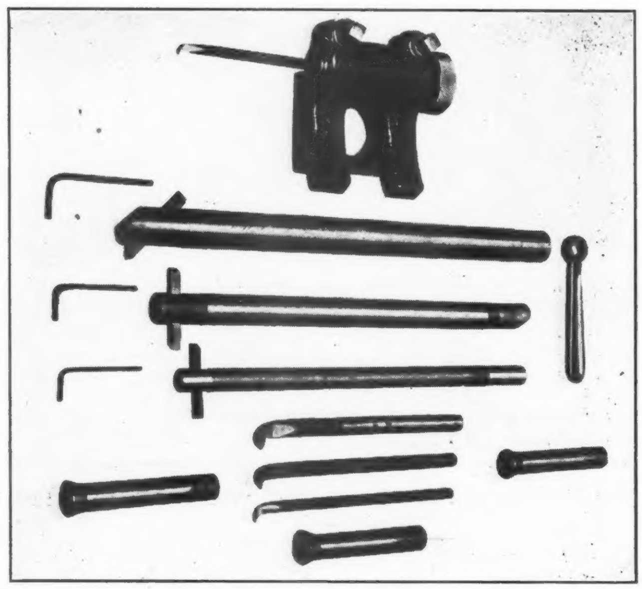
The drawing shows the form of the tools used for tire turning. Because of the difficulty of grinding, a finishing tool of circular contour, conforming to the radius of the throat of the flange is used instead of a tool formed to the complete contour of the flange and tire.

The increase in efficiency of Widia (the chip cross-section X the cutting speed), as compared with tool steels, are said to vary from 75 per cent to 200 per cent on steels, the higher efficiencies occurring with the lower tensile strength; 400 per cent on chilled cast iron, 200 to 600 per cent on cast irons, of varying Brinell numbers, the higher efficiencies occurring with the lower tensile strengths; 400 per cent on chilled cast iron, similar materials, and 800 per cent on brass. These efficiencies are based on retaining the customary chip cross section and increasing the cutting speeds of the machine.

Adjustable boring and turning bars for lathes

THE Scully Steel & Iron Company, Chicago, has placed on the market an adjustable boring and turning bar for use on lathes. In addition to boring and turning, this bar can also be used for both external and internal threading.

The bars are of one-piece construction, made of special alloy steel, with the ends heat treated. The holders are so made that the bars can be adjusted over a large range. The large bearing surface in the holder for the bars insures that they will be rigidly held. By reversing the holder, the largest piece that the lathe will swing can be turned. The bars are always held parallel with the lathe center.



The toolholder and the various sizes of boring tools that can be used with it

These bars can be obtained in several different sets, ranging from extremely small tools to very large bars.

These bars are designed so as to fit over tool posts or into cross slides.

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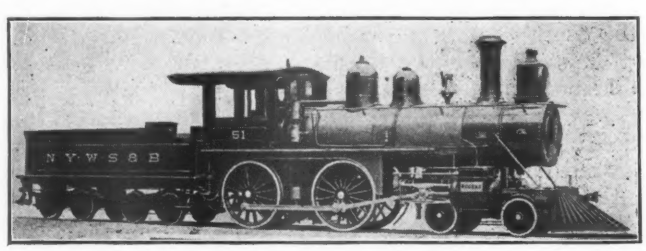

4-4-0 type on the New York, West Shore & Buffalo built by the Rogers Locomotive Works, Paterson, N. J.

News of the Month

Locomotives exempted from Rule 116 (i)

The Interstate Commerce Commission on October 10 made public an order by which Rule 116 (i), of its rules for the inspection and testing of steam locomotives, requiring that steam locomotives be equipped with cab storm windows, shall not apply to locomotives used on the Panhandle division of the Pennsylvania. The rules provide for an exemption if, upon investigation, it is found that clearness will not permit safe operation of locomotives equipped with storm windows.

At the same time the commission denied a petition of the Chesapeake & Ohio for exemption of locomotives used on its lines, saying that "practically all, if not all, locomotives used on the lines of the carrier are now, and for several years have been, equipped with cab storm windows and the same have been used with safety."

Equipment installed in 1928

Class I railroads, in the first eight months this year, installed 42,572 freight cars, according to reports filed by the carriers with the Car Service Division of the American Railway Association. Compared with the corresponding period last year, this was a reduction of 9,702 in the number of freight cars installed. Freight cars on order on September 1 this year totaled 9,257 compared with 18,764 on the same date last year. During August, the railroads installed 6,718 freight cars compared with 7,131 in August last year.

Locomotives placed in service by the Class I railroads during the first eight months in 1928 totaled 995, which was a decrease of 304 compared with the corresponding period last year. Locomotives installed in August were 114 as compared with 104 placed in service in August, 1927, while locomotives on order on Stepember 1 totaled 100 as compared with 207 on the same date in 1927. These figures as to freight cars and locomotives included new and leased equipment.

Equipment in need of repairs

A new low record for all time in the number of locomotives in need of repair was established by the railroads of this country on September 1, according to reports filed today by the carriers with the Car Service Division of the American Railway Association.

The number in need of repair on that date was 7,954, or 13.4 per cent of the number on line. The record established on September 1 exceeded by 52 locomotives the best previous record attained on July 1 this year.

This new low record, which applies to all steam locomotives, more than reaches the goal set, so far as motive power is concerned, by the railroads of this country in 1923 when a program was adopted by them calling for the maintenance of adequate and efficient transportation service. At that time, the goal agreed upon called for a reduction to 15 per cent in the number of steam locomotives in need of heavy repairs. The number of such locomotives in need of repair on September 1 was a decrease of 873 compared with the number in need of repair on August 15, at which time there were 8,827 or 14.9 per cent. Locomotives in need of classified repairs on September 1 totaled 4,486, or 7.6 per cent, a decrease of 440 compared with August 15, while 3,468, or 5.8 per cent, were in need of running repairs, a decrease of 433 compared with August 15.

Class I railroads on September 1 had 6,504 serviceable locomotives in storage compared with 6,712 on August 15.

On September 1 there were 149,252 freight cars in need of repair, or 6.6 per cent of the number on line. This was a decrease of 4,803 cars below the number reported on August 15, at which time there were 154,055, or 6.9 per cent.

Freight cars in need of heavy repairs on September 1 totaled 109,010, or 4.8 per cent, a decrease of 205 compared with August 15, while freight cars in need of light repairs totaled 40,242, or 1.8 per cent, a decrease of 4,598 compared with August 15.

Meetings and Conventions

Mechanical Division, A.R.A., to meet at Los Angeles

Pacific coast railroad men who, as members of the A. R. A. Mechanical division, have been attending annual meetings held in the East for years, will have an opportunity to play host to the next convention. The General Committee of the division has decided that the 1929 meeting will be held at Los Angeles, Cal., in the latter part of June, the definite date to be announced later. This will be the first time that the convention has ever met west of Chicago, except in 1887 when the annual meeting was held at Minneapolis, Minn.

Division VI appoints committees

Division vi, Purchases and Stores, A. R. A., of which C. C. Kyle, purchasing agent, Northern Pacific, is chairman, W. J. Farrell, secretary, and G. E. Scott, purchasing agent, Missouri-Kansas-Texas, chairman of committee aopointments, has assigned the subjects for committee work during the year and determined upon the personnel of each committee. A committee on terminal storekeeping has been added to the list, bringing the number of active committees to 17. New chairmen have been appointed in all but one instance. A list of chairmen and the subjects assigned for committee action follows:

Store department book of rules—E. G. Ellenberger, general material supervisor, Pennsylvania.

Classification of material—F. J. McMahon, general storekeeper, N. Y. C.

Reclamation of discarded material—classification, handling and sale of scrap—E. J. Becker, traveling storekeeper, S. P.

Joint committee with Mechanical Division on reclamation—I. C. Bon, superintendent scrap and reclamation, Wabash.

Uniform accounting and material store expenses—C. H. Murrin, special accountant, I. C.

Forest products—Paul McKay, assistant purchasing agent, N. P.

Buildings and facilities for handling material—A. B. Lackey, division storekeeper, Southern.

Clayton anti-trust act—E. A. Clifford, general purchasing agent, C. & N. W.

Standardization and simplification of stores, stocks and disposition of surplus materials—L. V. Hyatt, supervisor of standardization, M. P.

Stores department safety practices—F. A. Murphy, district storekeeper, B. & O.

Terminal railway storekeeping—E. H. Polk, district storekeeper, S. P.

Control of line stocks—W. R. Culver, general storekeeper, P. M.

Joint committee on metric system—J. W. Gerber, general storekeeper, Southern.

Nominating committee—O. Nelson, general storekeeper, U. P.

Committee on committees—G. E. Scott, purchasing agent, M-K-T.

Control of shop orders—J. T. Kelly, general storekeeper, C. M. St. P. & P.

Control of material—L. P. Krampf, supply agent, M. P.

Unit pricing and unit piling—J. J. Kukis, superintendent of stores, Erie.

Purchasing office records and organization, including price index, of railroad commodities—H. L. Taylor, assistant purchasing agent, C. N.

Stationery and printing—E. J. Lamneck, assistant purchasing agent, Penna.

Fire Prevention—Q. A. Parker, division storekeeper, A. T. & S. F.

Delivery of material—H. M. Smith, assistant general storekeeper, N. P.

Railroad division, A. S. M. E., sponsoring national meeting

The Executive Committee of the Railroad Division, American Society of Mechanical Engineers, is completing arrangements for the co-ordination of the complete program of the annual winter meeting of the society, which is to be held in the Engineering Societies Building, 29 West Thirty-Ninth street, New York, December 3 to 7, 1928, inclusive, so as to afford the railway mechanical engineer employed in the railroad or railway supply industries, all the advantages of a national division meeting. This procedure, instead of having a separate National Railroad Division meeting extending over a period of several days, was adopted due to the fact that there are already a considerable number of associations that hold conventions during the year and the Executive Committee, Railroad Division, did not consider it advisable to add another. Instead, it is taking advantage of the papers and reports being presented by other professional divisions at this meeting and together with its own two-sessions program of four papers, it has developed a program for the railway mechanical engineer which extends over the entire five-day period.

The annual winter meeting of the A. S. M. E. has been an established feature of the society for many years. In addition to the technical program, the National Exposition of Power and Mechanical Engineering will be held at the Grand Central Palace, New York. The seventh exposition which is to be held December 3 to 8, 1928, inclusive, will have a large display of the latest developments in power plant, heating and ventilating and other mechanical equipment. The program has been arranged so as to afford a minimum of conflict between meetings in which the railway mechanical engineer may be interested.

The following is the consolidated program that has been planned by the Executive Committee of the Railroad Division:

Monday, December 3

Fixture design: Principles of jig and fixture practice, by Jos. W. Roe.
Open house.

Tuesday, December 4

Methods of motor application and controls on lathes, by C. L. Cameron.
Motors for planer service, by Forrest E. Cardullo.
Motor Drives for precision grinding, by R. E. W. Harrison.
Application of motors to special drilling and tapping machinery, by J. H. Mansfield.
Balancing heat and power in industrial plants, by Robert V. Kleinschmidt.
Material handling problems in the public utility, by John C. Somers.

Wednesday, December 5

Coal pulverizers, by W. J. A. London.
Analysis of oil-engine performance with a view to rating, by Otto Nonnenbruch.
Refrigeration in railroad freight cars, by J. W. Martin, Jr.
Characteristics of injectors with special reference to their utility as locomotive feedwater heaters, by R. M. Ostermann.
Designing buildings for daylight, by H. H. Highbie and W. C. Randall.
Artificial lighting provision in building design and process layout, by Ward Harrison.
Light as a factor in production, by C. C. Monroe and H. A. Cook.
The Schmidt high-pressure locomotive of the German State Railway Company, by R. P. Wagner.
The balancing and dynamic rail pressure of locomotives, by R. Eksergian.
Annual dinner, Hotel Astor.

Thursday, December 6

Design of steam piping to care for expansion, by W. H. Shipman (by title).
The executive function in industry, by Robert T. Kent.
Cooling and lubrication of cutting tools (Report of Sub-Committee on Cutting Fluids of the Special Committee on Cutting Metals).
Zeolite softeners internal treatment, priming and foaming, Sub-Committee No. 3, by C. W. Foulk.
Standard methods of water analysis, Sub-Committee No. 8, by H. Farmer.
Skid handling of interplant shipment:
New developments in materials handling, by R. L. Lockwood.
Viewpoint of railroads, by J. V. Miller.
Economic aspects of the shipment of material on skid platforms, by C. B. Crockett.
Skid platform shipment of commodities, by F. J. Shepard, Jr.
Stresses in heavy closely coiled helical springs, by A. M. Wahl.
Fatigue and fatigue-corrosion of spring materials, by D. J. McAdam.
Progress report of the Research Special Committee on Mechanical Springs.

Friday, December 7

Heavy-duty anti-friction bearings, by S. D. Koon.
Silica Gel, by George E. Hulse.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

AIR-BRAKE ASSOCIATION.—T. L. Burton, 165 Broadway, New York. Next meeting, April 30-May 3, 1929, at Stevens Hotel, Chicago.

AMERICAN RAILWAY ASSOCIATION DIVISION V—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago. Annual meeting June, 1929, at Los Angeles, Cal.

DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago.

DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, Marion B. Richardson, associate editor, *Railway Mechanical Engineer*, 30 Church St., New York. Annual meeting December 3 to 7, inclusive. Railroad Division sessions, Wednesday, December 4.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charon St., Montreal, Que. Regular meetings, second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que. Next meeting November 13 at 8:15 p.m. A paper on the use of pulverized fuel for power plants will be presented by D. Irish, Foster Wheeler Company, New York. Beginning with the December meeting, the Canadian Railway Club will meet on the second Monday, instead of on the second Tuesday.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, Chicago & Alton, Chicago, Ill. Regular meeting second Monday in each month, except June, July and August, Great Northern Hotel, Chicago.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth St., Los Angeles, Cal. Meeting second Friday of each month in the Pacific Electric Club building, Los Angeles, Cal.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—A. J. Walsh, 5874 Plymouth Apt. 18, St. Louis, Mo. Regular meeting first Tuesday in each month, except June, July and August, at Broadview Hotel, East St. Louis, Ill. Next meeting November 13 at 8 p.m. A paper on loading rules will be presented by M. E. Fitzgerald, general car inspector, Chicago & Eastern Illinois.

CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York. Regular meetings second Tuesday each month, except June, July and August, at Hotel Statler, Buffalo.

CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—See Master Car Builders' and Supervisors Assn.

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 3328 Beekman St., Cincinnati. Regular meeting second Tuesday, February, May, September and November.

CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meeting first Monday each month, except July, August and September, at Hotel Hollenden, East Sixth and Superior Ave. Next meeting November 5, at 8 p.m. A paper on a temperature study of car journals in motion will be presented by W. H. Davis.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—L. G. Plant, Railway Exchange, 80 E. Jackson Boulevard, Chicago. 1929 Annual meeting Hotel Sherman, Chicago, May 7-10, inclusive.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash Ave., Winona, Minn.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, 3212 Delachaise street, New Orleans, La. Meetings third Thursday in each month.

MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York. Annual meeting May 21-24, 1929, Hotel Biltmore, Atlanta, Ga.

MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago, Chicago.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in each month, excepting June, July, August and September, Copley-Plaza Hotel, Boston. Next meeting, November 13. Marine activities of the Canadian Pacific will be discussed by H. B. Beaumont, steamship passenger agent, Canadian Pacific.

NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth St., New York.

PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings, second Tuesday of each month in San Francisco and Oakland, Cal., alternately.

RAILWAY CAR DEPARTMENT OFFICERS' ASSOCIATION.—See Master Car Builders and Supervisors' Association.

RAILWAY CLUB OF GREENVILLE.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meeting third Thursday of each month, except June, July and August. Next meeting November 20 at 6 p.m. Paper on car service will be read by J. C. Bailey, car service agent, B. & L. E.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, M. P. O. Drawer 24, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting third Thursday in November. Ansley Hotel, Atlanta, Ga.

SOUTHWEST MASTER CAR BUILDERS AND SUPERVISORS ASSOCIATION.—See Master Car Builders' & Supervisors' Association.

TRAVELING ENGINEER'S ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio.—Annual meeting Hotel Sherman.

WESTERN RAILWAY CLUB.—W. J. Dickinson, 189 West Madison St., Chicago. Regular meetings, third Monday in each month, except June, July and August. Next meeting November 19, at 8 p.m. Paper on the Caprotti poppet valve will be read by W. A. Austin, consulting engineer, Baldwin Locomotive Works.

Supply Trade Notes

THE GENERAL OFFICE of the Chisholm Moore Hoist Corporation has been moved to Tonawanda, N. Y.

THE D. S. MAIR MACHINERY COMPANY, Houston, Tex., has been appointed Texas agent for the Whiting Corporation, Harvey, Ill.

THE LINDE AIR PRODUCTS COMPANY, New York, has opened a new plant at 125 Settlement street, Akron, Ohio, in charge of A. Deagon, superintendent.

T. E. BARNUM has been appointed consulting engineer of the Cutler-Hammer Mfg. Company, Milwaukee, Wis. N. L. Mortensen succeeds Mr. Barnum as chief engineer.

J. C. BLOOMFIELD, district manager of the Industrial Works, Bay City, Mich., has resigned to become manager in charge of railway sales for the Harnischfeger Sales Corporation, Milwaukee, Wis.

THE VANADIUM CORPORATION OF AMERICA, New York, has opened an office in the Henry W. Oliver building, Pittsburgh, Pa. under the direction of J. Alfred Miller, Jr., general manager of sales.

THE BAKER-RAULANG COMPANY, Cleveland, Ohio, has appointed the Marquette Railway Supply Company, Chicago, as its special representative for all railroads making their headquarters in Chicago.

RAYMOND E. MILLER, assistant chief engineer of the Westinghouse Air Brake Cimpany at Wilmerding, Pa., has been appointed general engineer, instead of general manager as noted in the October issue of the *Railway Mechanical Engineer*.

ALFRED B. KREITZBURG, advertising manager of the Electric Storage Battery Company, Philadelphia, Pa., died on October 15, at his home in Springfield, Delaware county, Pa., at the age of 43. Mr. Kreitzburg, whose connection with the Electric Storage Battery Company had extended over many years, had been ill for over a year.

H. K. WILLIAMS, for the past twelve years in the sales department of the Safety Car Heating and Lighting Company, has been appointed manager of the equipment department, with headquarters at 75 West street, New York City. Mr. Williams is in charge of sales of axle lighting equipment, batteries and accessories. L. Schepmoes, manager of sales service department at New Haven, Conn., has been appointed manager of the fixture department, in charge of sales of lighting fixtures, fans and similar materials, with headquarters at New Haven.

HENRY C. BUHOUP, second vice-president of the Chicago Railway Equipment Company from 1899 to 1905 and representative of the McConway & Torley Company, Pittsburgh, Pa., from 1882 to 1921, with headquarters at Chicago, died at Pasadena, Cal., on September 29. Mr. Buhoup was born at Pittsburgh, Pa., on May 6, 1845. In 1886 he became one of the organizers of the National Hollow Brake Beam Company, which later became the Chicago Railway Equipment Company and during his connection with the latter company was in charge of sales.

MAX K. RUPPERT has been appointed assistant eastern manager of The P. & M. Company and L. S. Walker has been appointed eastern manager, both with headquarters at New York. Mr. Walker, who succeeds F. N. Baylis, was born on November 21, 1888, at Woodstock, Va. He attended Virginia Polytechnic Institute and was graduated with a degree of civil engineer in 1910. Previous to this, during the summer of 1907-1908, he served in the construction department of the Illinois Central, engaged in the building of the Baton Rogue, Hammond & Eastern. During 1910-1911, he took a special course at Lehigh University and the following year entered the service of the Chesapeake & Ohio. Later he served in the maintenance department of the Illinois Central as instrument man, and, in 1913, went to the P. & M. Company in its production department. In May, 1914, he entered the service and sales department, eastern territory, at the New York office, and, in 1918, was appointed eastern sales agent of the same company, becoming eastern sales manager in 1926. He held this position at the time of his appointment as eastern manager.

THE AMERICAN CAR & FOUNDRY COMPANY has organized a research department, of which William H. Woodin, Jr., the son of the head of the American Car & Foundry Company and the American Locomotive Company, has been placed in charge, with the title of director of research. Mr. Woodin has appointed as his assistants A. H. Wobbe, assistant director of research; J. W. Steinmeyer, research engineer, and R. M. Allen, research metallurgist. It is the improvements which have already been made in several of the company's products as a result of Mr. Woodin's research and experiments in metallurgy, that have led to the establishment of a complete organization for the future handling of research problems. Mr. Woodin acquired his practical experience at the Berwick, Pa., plant of the American Car & Foundry Company where he has served as an iron worker and a molder. Aside from his work in metallurgy, his activities as a microscopist and electrical engineer have already attracted attention. His headquarters will be at the executive offices of the company, 30 Church street, New York.

William H. Woodin, Jr.

H. A. MULLET, who has been elected president of the Bradley Washfountain Company, Milwaukee, Wis., was born at Louisville, Ky., on December 11, 1880, and attended high school at Kansas City Mo. In 1904 he completed a course in electrical engineering at Rose Polytechnic Institute and, in the same year entered the service of the Westinghouse Electric & Manufacturing Company at Pittsburgh, Pa. In 1906, he was appointed assistant to the superintendent of equipment of the Milwaukee Electric Railway & Light Company. Later he served as superintendent of equipment and, in 1918, was promoted to the position of assistant general manager of the transportation department, his jurisdiction being extended in the following year to include motor coach operations. From 1922 to 1925, Mr. Mullet acted as vice-president and general manager of the Milwaukee Northern, a subsidiary of the Milwaukee Electric Railway & Light Company. During the latter year he was appointed vice-president of the Yellow Cab Company, Chicago, and, in 1926, elected vice-president of the Twin City Rapid Transit Company, Minneapolis, Minn.

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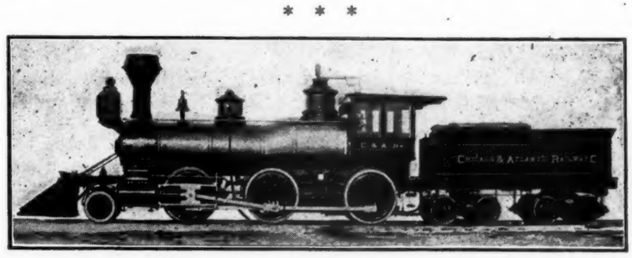

Mogul locomotive built in 1883 for the Chicago & Atlantic—18-in. by 24-in. cylinders and 56-in. driving wheels

Personal Mention

General

W. Y. Cherry, superintendent of motive power of the Long Island, has been appointed general superintendent of motive power of the New York Zone of the Pennsylvania, of which the Long Island is a part.

Master Mechanics and Road Foremen

H. K. Le Sure, master mechanic of the Eastern region of the Pennsylvania, with headquarters at New York, has been appointed master mechanic of the New York Zone, with headquarters in the same city. Mr. Le Sure will have jurisdiction over the Long Island and the electrified portion of the New York division.

Shop and Enginehouse

R. A. Thurston has been appointed general foreman, mechanical department, of the Union Pacific, with headquarters at La Grande, Oregon.

Thomas J. Stocks, machine shop foreman of the Green Bay & Western at Green Bay, Wis., has been promoted to superintendent of shops, with jurisdiction over both locomotive and car shops and headquarters at the same point.

Purchases and Stores

B. W. Roberts, assistant general purchasing agent of the Canadian Pacific at Montreal, Que., has been appointed general purchasing agent, with the same headquarters, succeeding E. N. Bender, retired.

B. W. Roberts

Mr. Roberts, born on August 17, 1890, at Winnipeg, Man. He entered the service of the Canadian Pacific in September, 1907, as a clerk in the treasury department at Winnipeg, later being transferred in the same capacity to the purchasing department at Vancouver. In May, 1912, he was appointed assistant commissary agent; in January, 1913, promoted to commissary agent; later in the same year became assistant to the chief commissary agent and in December, 1913, appointed assistant to the general purchasing agent. He was appointed purchasing agent at Calgary in January, 1919, and later in the same year, was transferred in the same capacity to Vancouver, where he served until December, 1923, at which time he was appointed assistant general purchasing agent at Hontreal.

Car Department

H. Y. Monroe, car foreman of the Southern at Goldsboro, N. C., has been transferred to the Forrest shops, Memphis, Tenn.

C. W. Frey, superintendent of shops of the Michigan Central at West Detroit, Mich., has been promoted to master car builder, with headquarters at Detroit.

James Bowen has been appointed superintendent of shops of the Michigan Central, with headquarters at West Detroit, Mich., succeeding C. W. Frey.

H. Hickenbotham, car foreman in the Western region of the Canadian National at Port Mann, B. C., has been promoted to the position of general car foreman of the British Columbia district, with headquarters at Vancouver, B. C.

Abram L. Yost, car foreman of the Chicago, Rock Island & Pacific at El Reno, Okla., has retired after almost 41 years of continuous service.

John G. Shuster, blacksmith foreman of the Chicago, Rock Island & Pacific at Chickasha, Okla., has retired after 25 years' continuous service.

Obituary

Charles H. McConnell, mechanical engineer on the Pittsburgh & Lake Erie, died suddenly on October 20. Mr. McConnell was 49 years of age and had been in the employ of the Pittsburgh & Lake Erie for 27 years, having first entered its service in October, 1902, as an electrician and subsequently serving as assistant electrical engineer, and electrical engineer. He was appointed mechanical engineer in September, 1927.

James E. Goodman, master mechanic of the Northern Pacific at Duluth, Minn., from 1902 until his retirement on December 31, 1922, died at Los Angeles, Cal., on August 26, at the age of 78 years. At the time of his retirement, Mr. Goodman had been in railway service for 54 years, 44 years of which had been with the Northern Pacific. While general division airbrake inspector at St. Paul, Minn., in 1902, he served as president of the Air Brake Association.

John Opheim, general storekeeper of the Great Northern at St. Paul, Minn., from 1910 to 1916, died at his home in Tacoma, Wash., on August 6. He entered the service of the Great Northern in 1880 in the mechanical department at Fergus Falls, Minn. Later, because of an injury, he was transferred to the store department and in 1908 was advanced to storekeeper at Hillyard, Wash. In 1910 he was promoted to general storekeeper and from 1916 to 1925, when he retired from active service, he served successively at Hillyard and at Marcus, Wash., as division storekeeper.

John T. Heidler, general foreman of the Norfolk & Western at Kenova, W. Va., died on July 1. Mr. Heidler was born at Duphin, Pa., and entered the service of the Norfolk & Western on February 2, 1893, as a machinist apprentice, Bluefield shop. On June 1, 1897, he was transferred to Roanoke as a machinist, and on May 21, 1902, was promoted to position of enginehouse foreman at Portsmouth, Ohio. On October 21, 1909, he was appointed shop foreman, with headquarters at Columbus, Ohio. He returned to the Bluefield shop on April 1, 1912, as general foreman. He later served as master mechanic, and on January 1, 1922, was appointed general foreman at Kenova.

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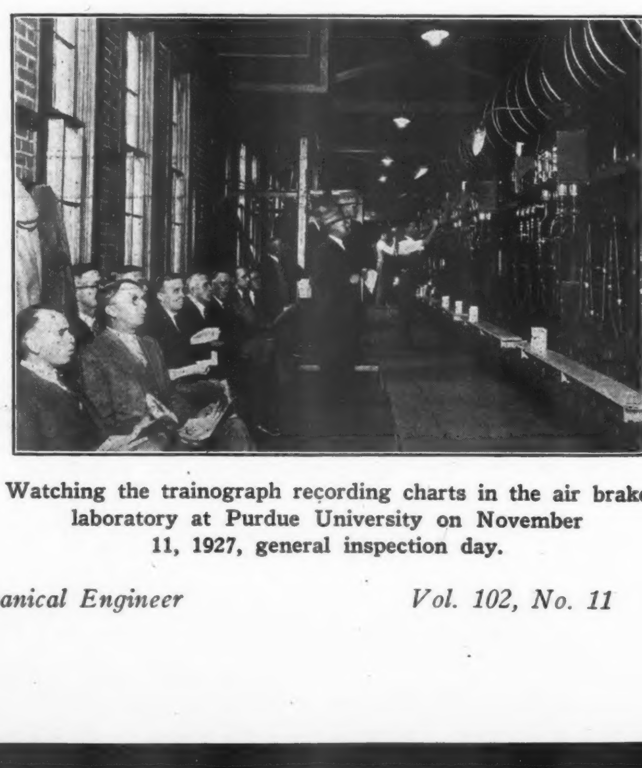

Watching the trainograph recording charts in the air brake laboratory at Purdue University on November 11, 1927, general inspection day.